Ethiopian TVET-System

Health Extension Service

Level III

Based on Jan.2018G.C Occupational Standard

Module Title	**Promoting and Implementing Hygiene and Environmental health**
TTLM Code	**HLTHES3 MO5 TTLM 0919v1**

This module includes the following Learning Guides

LG16: Promote and provide environmental and personal hygiene education

LG17:Establish and demonstrate community-appropriate sanitation technologies

LG18:Provide environmental health services

LG19:Provide information on food and drink hygiene and safety

Instruction Sheet #1	LG16: Promote and provide environmental and personal hygiene education

This learning guide is developed to provide you the necessary information regarding the following **content coverage** and topics:

- Promoting concepts and Principles of Hygiene and Environmental Health.
- Providing Personal Hygiene
- Promoting Environmental Health Hazards
- Planning in personal hygiene and environmental health
- Promoting Healthful Housing
- Promoting Institutional Hygiene and sanitation
- Compiling and submitting Reports
- Monitoring environmental health activities

This guide will also assist you to attain the learning outcome stated in the cover page. Specifically, **upon completion of this Learning Guide, you will be able to**:

- Promote concepts and Principles of Hygiene and Environmental Health.
- Provide Personal Hygiene
- Promote Environmental Health Hazards
- Plan in personal hygiene and environmental health hazards
- Promote Healthful Housing
- Promote Institutional Hygiene and sanitation
- Compile and submit reports
- Monitoring environmental health activities

Learning Instructions:

1. Read the specific objectives of this Learning Guide.
2. Follow the instructions described below 3 to 6.
3. Read the information written in the information “Sheet 1, Sheet 2, Sheet 3 and Sheet 4”.
4. Accomplish the “Self-check 1, Self-check t 2, Self-check 3 and Self-check 4” **in page -6, 9, 12 and 14** respectively.
5. If you Learned a satisfactory evaluation from the “Self-check” proceed to “Operation Sheet 1, Operation Sheet 2 and Operation Sheet 3 ” **in page**
6. Do the “LAP test” **in page – 16** (if you are ready).

Information Sheet-1	Promoting concepts and Principles of Hygiene and Environmental Health.

1.1 Principles and concepts of Hygiene and Environmental Health

1.1.1 Definition of terms

- **Hygiene: -** Refers to the set of practices associated with the preservation of health and healthy living.
  - ✓ The focus is mainly on personal hygiene that looks at cleanliness of the hair, body, hands, fingers, feet, clothing, and menstrual hygiene.
  - ✓ Improvements in personal knowledge, skill and practice that modify an individual's behavior towards healthy practice are the focus of hygiene promotion.
- **Sanitation:-**Means the prevention of human contact with wastes, for hygienic purposes.
  - ✓ It also means promoting health through the prevention of human contact with the hazards associated with the lack of healthy food, clean water, healthful housing, the control of vectors (living organisms that transmit diseases), and a clean environment.
  - ✓ It focuses on management of waste produced by human activities.
- There **are different types of sanitation relating to particular situations, such as:**
  - ✓ **Basic sanitation**: refers to the management of human faeces at the household level. It means access to a toilet or latrine.
  - ✓ **Onsite sanitation**: the collection and treatment of waste at the place where it is deposited.
  - ✓ **Food sanitation**: refers to the hygienic measures for ensuring food safety.
  - ✓ **Food hygiene is similar to food sanitation**. . Housing sanitation: refers to safeguarding the home environment (the dwelling and its immediate environment).
  - ✓ **Environmental sanitation**: the control of environmental factors that form links in disease transmission. This category includes solid waste management, water and wastewater treatment, industrial waste treatment and noise and pollution control. .
  - ✓ **Ecological sanitation**: the concept of recycling the nutrients from human and animal wastes to the environment.
- **Environment:-**Is the sum of all external influences and conditions which effect/affect/ health, life, and growth.
- **Environmental health:-E**nvironmental health is broader than hygiene and sanitation; it encompasses hygiene, sanitation and many other aspects of the environment such as global warming, climate change, radiation, gene technology, flooding and natural disasters.
  - ✓ The **World Health Organization's** definition is Environmental health addresses all the physical, chemical, and biological factors external to a person, and all the related factors impacting behaviors. It encompasses the assessment and control of those environmental factors that can potentially affect health.

1.1.2. Concepts and Principles of Hygiene and Environmental Health

The diarrhea transmission represents a good way to understand the pathways of disease through the environment and how environmental health and hygiene can help to prevent disease transmission. Human excreta always contain large numbers of germs, some of which may cause diarrhea. When people become infected with diseases such as cholera, typhoid and hepatitis A, their excreta will contain large amounts of the germs which cause the disease.

- **Illustrates the specific transmission pathways along with water; sanitation and hygiene minimize faeco-orally transmitted disease:-**
  - ✓ **On the left** are human faeces, representing the source of diarrhea. The infectious agent or disease agent is actively discharged by a patient or carrier of the disease.
  - ✓ **On the right**, there is a host who is a person that could be affected by the disease.
  - ✓ **Between the two,** there is the part of the environment that links the two, in other words, the pathway that the disease transmission agents travel between the source and the host.

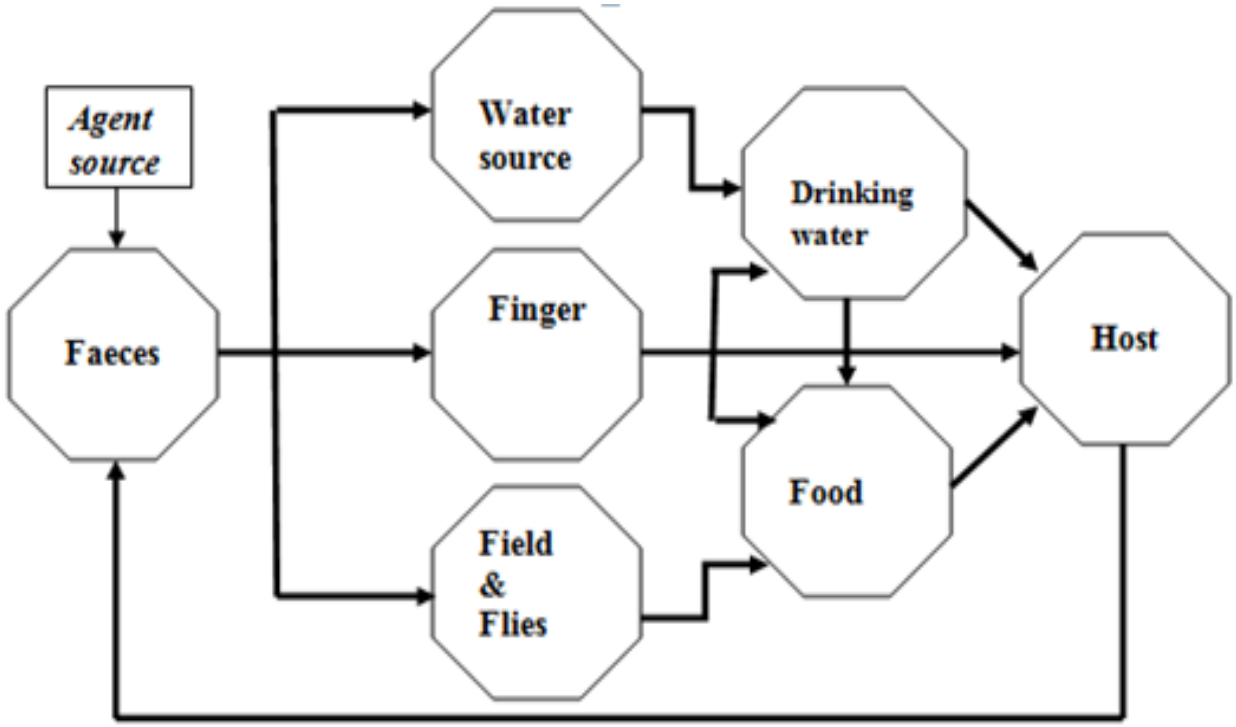

Figure 1.1(a):- Faeco-oral contamination: arrows represent transmission routes for pathogens

- **Interventions act to minimize or to control the disease transmission pathways:-**

Scenario 1: Improved sanitation aims **(intervention at source)** to break the cycle of disease transmission from faeces to the environment in the first round.

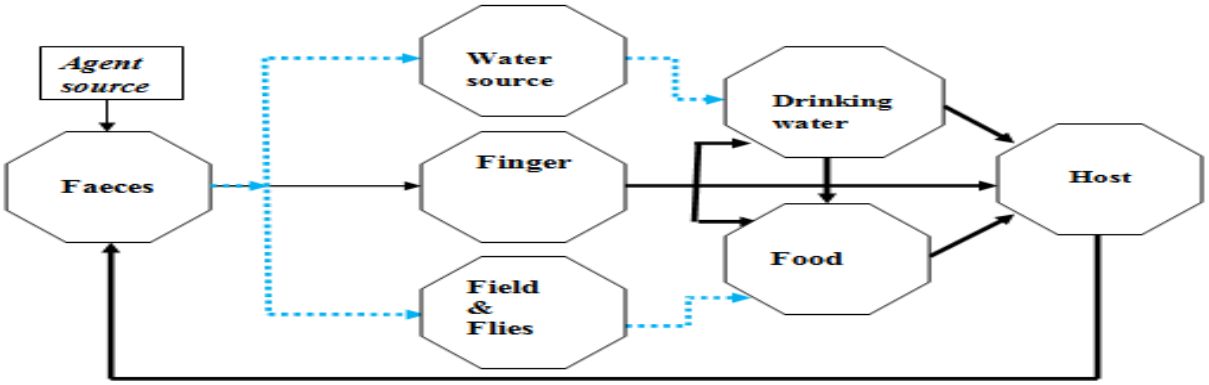

Figure 1.1: (b) Sanitation as barriers to transmissions

Scenario 2: Hygiene (**environmental)** interventions aim to break second round transmission routes.

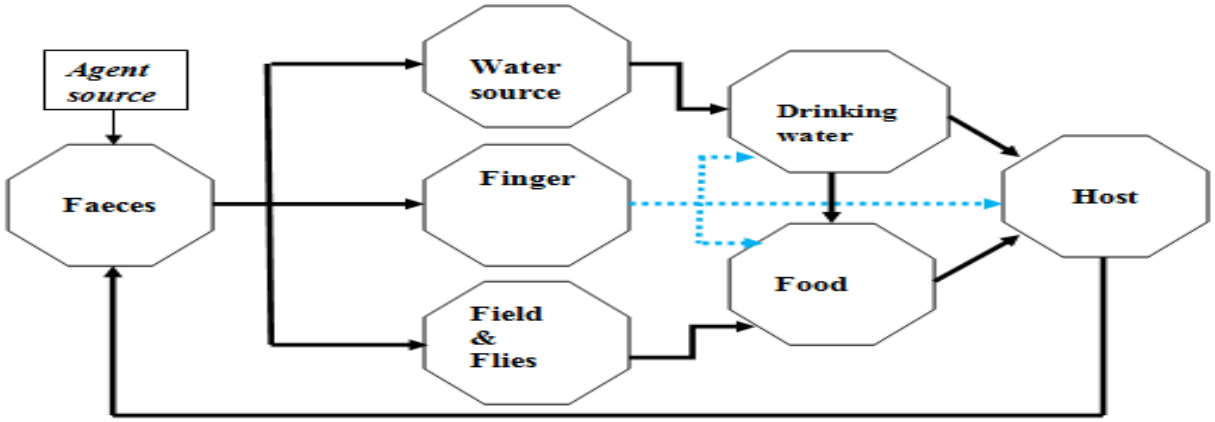

Figure 1.1: (c) Hygiene as barriers to transmission

Scenario 3: Water **(environmental)** interventions aim to break second round transmission routes.

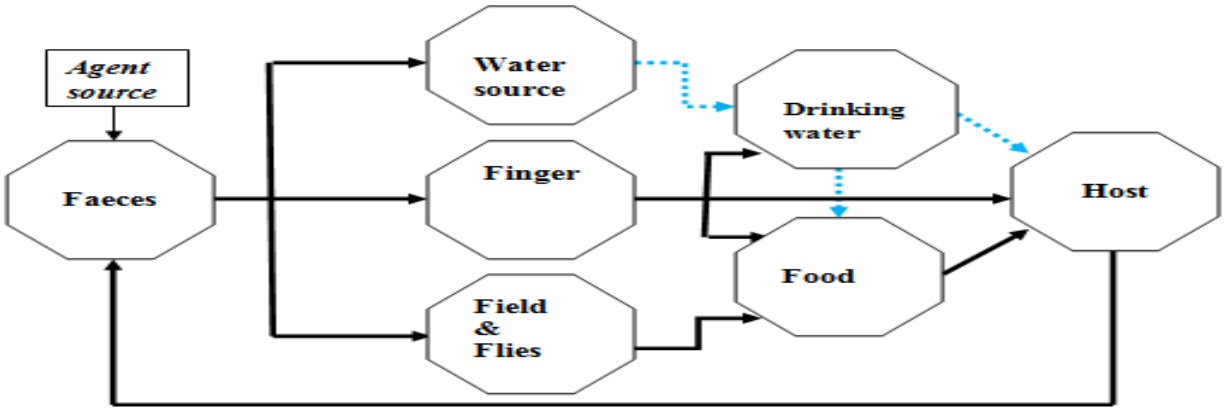

Figure 1.1: (d) Water treatments at source or point-of-use as a barrier to transmission

- **From the above figure we can observe that the possible pathways of diarrhea are six _F's:-**
    1. **Faeces:** resulting from defecation
    2. **Fluids**: through contaminated water
    3. **Fingers:** contaminated fingers transmit diseases
    4. **Flies:** all sorts of animals such as flies can carry and transmit diseases
    5. **Fomites or fields**: fomites are inanimate objects that carry the infectious agent (e.g. dishes, cups and other contaminated surfaces in contact with food or water)
    6. **Food:** infected by fluids, flies, fingers or fomites and then eaten.

1.1.3 Components of Environmental Health

- **Environmental health and hygiene that will be importance to public health worker and it has the following components:**

1. **Personal hygiene**: Hygiene of human body and clothing.
2. **Water supply:** Adequacy(quantity), safety, quality/ (chemical, bacteriological, physical) of water for domestic /cleaning and cooking/, drinking and recreational use
3. **Human waste disposal:** Proper excreta disposal and liquid waste management
4. **Solid waste management**: Proper application of storage, collection, disposal of waste. Waste production and recycling
5. **Vector control**: Control of rodents (vertebrate such as rats) and arthropods (invertebrate insects such as flies and other creatures such as mites) that transmit disease
6. **Food hygiene:** Food safety and wholesomeness in its production, storage, preparation, distribution and sale, until consumption
7. **Healthful housing:** Physiological needs, protection against disease and accidents, psychological and social comforts in residential and recreational areas
8. **Institutional health:** Communal hygiene and sanitation in schools, prisons, health facilities, refugee camps, public offices ,religious areas and settlement areas
9. **Air pollution**: Sources, characteristics, impact and mitigation both at in-door and outdoor .
10. **Occupational health:** Hygiene and safety in the workplace

Figure 1.2: Illustrates components of hygiene and environmental health

1.1.4 Role of Environmental Health in Public Health

- Environmental health is a part of public health where the primary goal is preventing disease and promoting people's health. Environmental health is associated with recognizing, assessing, understanding and controlling the impacts of pollutants and contaminants on the people as well as on their environment.

- **The role of the environmental health worker, therefore, includes the following functions of public health:**
  a) Improving human health and protecting it from environmental hazards.
  b) Developing liaison between the community and the local authority, and between the local and higher levels of administration.
  c) Acting independently to provide advice on environmental health matters; designing and developing plans of action for environmental health.
  d) Initiating and implementing health/hygiene, sanitation and environmental programmes to promote understanding of environmental health principles.
  e) Enforcing environmental legislation.
  f) Monitoring and evaluating environmental health activities, programmes and projects.

- **Environmental health Intervention Models**
  - According to the Federal Ministry of Health, more than 80% of communicable diseases in Ethiopia are believed to be preventable using environmental health interventions.

- **Generally, there are two intervention models:**
  1. **The clinical intervention model:-** which looks at treating the sick person.
  2. **The public health model: -** including environmental health, which looks at how to stop people getting sick in the first place by providing a healthy environment.

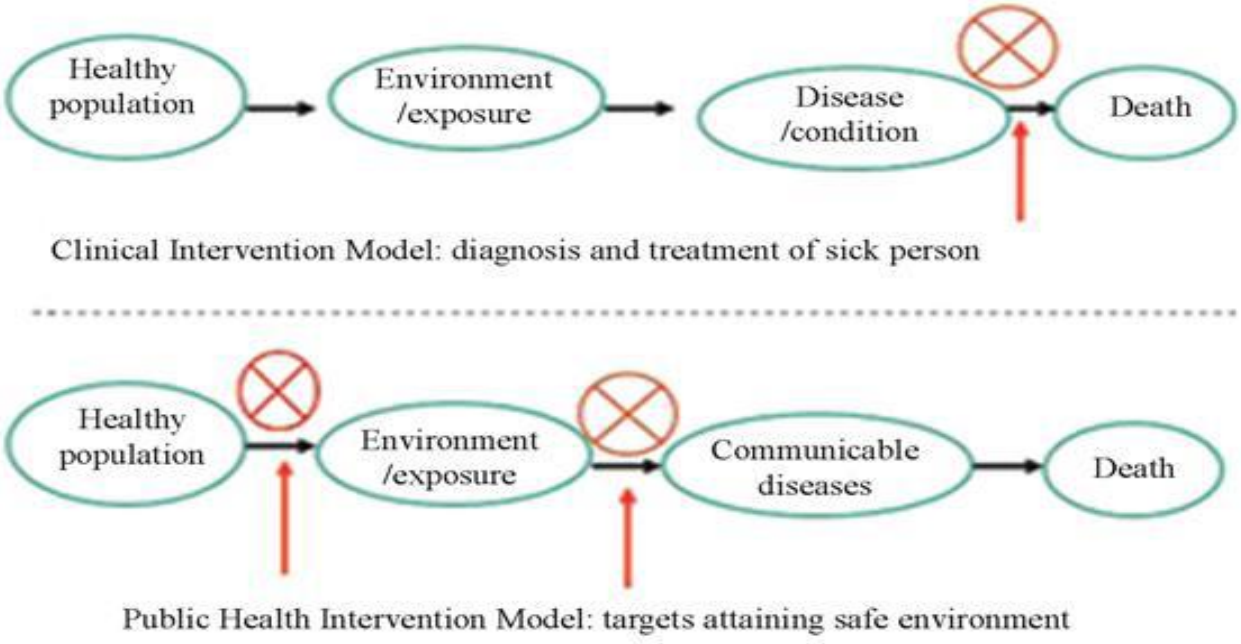

Figure 1.3: Health intervention models for the prevention and control of communicable diseases.

Self-Check -1	Written Test

I. Choose the correct answer from the given alternatives

1. From the sanitation types one refers to the management of human faeces at the household level.
   A) Basic sanitation **B)** Onsite sanitation **C)** Food sanitation **D)** housing sanitation

2. The Environmental intervention models, which looks at treating the sick person is
   A) The public health model **B)** The clinical model **C)** ALL **D)** None

3. The set of practice associated with prevention of diseases and preservation of health.
   A) Sanitation **B)** Environment **C)** Hygiene **D)** Health housing

4. The removal of both dirt and microorganism from individual.
   A) Cleanliness **B)** personal hygiene **C)** Air hygiene **D)** None

Note: Satisfactory rating - 4 points unsatisfactory below-4 points

You can ask you teacher for the copy of the correct answers

Answer Sheet

Score _____

Rating _____

Name: _____ Date: _____

Short Answer Question

1._____

2._____

3. ----------

4. ----------

1.2. Personal Hygiene

1.2.1 Definition of Personal Hygiene

Personal hygiene is a concept that is commonly used in medical and public health practices. It involves maintaining the cleanliness of our body and clothes. Practice of personal hygiene is employed to prevent or minimize the incidence and spread of communicable diseases (a mechanism used for breaking disease transmission cycle).

Personal hygiene is therefore, a measure taken at individual level to promote personal cleanliness so that transmission of diseases from source to susceptible hosts is prevented. Currently most of our health problems are occurred due to poor hygienic behavior. The benefits of safe water supply and sanitation efforts in a given community can easily be lost if the communities still carry on with the poor personal hygiene behavior. For example, a water source in a refugee settlement in Eastern Sudan was protected and tested as microbiologically safe. However, during transportation of water from the source to collection pots at home the quality has deteriorated by the time it was brought home. The same is true for foods that are brought to the market and finally to our home to prepare our breakfast, lunch or dinner. If community hygiene is not practiced during preparation, storage and service, the food can easily be contaminated and can cause food borne diseases. The water that we drink and the food we eat need to be kept in a sanitary condition and used hygienically.

Improvements in personal knowledge, skill and practice that modify an individual‘s behavior towards healthy practice are the focus of hygiene promotion. Safe hygiene practice includes a broad range of healthy behaviors, such as hand washing before food preparation and/or eating, after latrine visiting and after cleaning a child‘s bottom, and safe faeces disposal. When you carry out hygiene education and promotion the aim is to transfer knowledge and understanding of hygiene and associated health risks in order to help people change their behavior to use better hygiene practices.

1.2.2 Difference between Cleanliness and Hygiene

- The term cleanliness should not be used in place of hygiene.
  - **Cleaning** in many cases is removing dirt, wastes or unwanted things from the surface of objects using detergents and necessary equipment.
  - **Hygiene** practice focuses on the prevention of diseases through the use of cleaning as one of several inputs.
    - ✓ **Example:** A janitor cleans the floor of a health centre using detergent, mop and broom. She might also use chlorine solution to disinfect the floor. The cleaning process in this example is the removal of visible dirt by our necked eye, while the use of chlorine solution removes the invisible microorganisms.
    - ✓ Hygienic practice encompasses both cleaning for the removal of physically observable matters and the use of chlorine for the removal of microorganisms.

1.2.3 Public health Importance of Personal Hygiene

1. Preventing diseases transmission

- The fingers may get contaminated with one‘s own faeces, either directly or indirectly. Activities during defecation and child bottom-washing are additional opportunities for the contamination of the fingers that facilitate the transmission of faeco-orally diseases.

2. Aesthetic values

- A person with clean hands is proud while eating because they feel confident of preventing diseases. A teacher in a school is always happy to see their students with clean faces and eyes, and dressed in clean clothes. A mother is mentally satisfied to feed her infant with clean hands because she ensures the preservation of her child‘s health.

3. Social impact

- A person with poor personal hygiene might be isolated from friendship because telling the person about the situation might be sensitive and culturally difficult. The success of a job application or the chance of promotion could be affected by poor personal hygiene.

1.2.4 Components of Personal Hygiene

Keeping personal cleanliness costs very little when it is compared with its importance. In this case everybody can practice it at home with the available materials. Personal cleanliness includes; the hygiene of the hand, body, feet, tooth’s, face, cloths, genital areas, and the like.

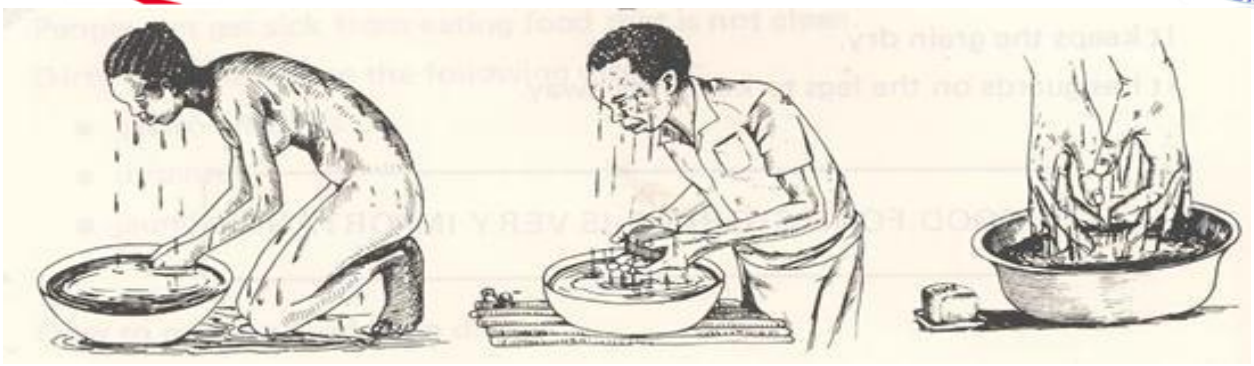

Figure 2.1: General body, face, and hand cleaning

1. Skin Hygiene

Sweat and oily secretion from the skin cause dust to stick on its surface. This clogs the skin pores and interferes with the natural function of the skin. Moreover, bacteria can readily breed on the surface of the skin to cause various disease and undesirable odor. Certain species of flies can deposit their eggs on clothes when left outside for drying and the larva will grow under human skin causing irritation.

If germs or parasites that settle on the skin as a result of poor personal hygiene produce a lesion, the barrier to protect delicate internal organs of the body is lost and infections such as scabies and ringworm are results of poor body hygiene.

Taking a bath or a shower using body soap at least weekly is very important to ensuring our body stays clean. Bathing can be every day or after periods of sweating or getting dirty. The genitals and the anal region need to be cleaned well because of the natural secretions of these areas.

Dry the body with a clean towel after thorough rinsing. Change into clean underwear after a bath. Changing sweat-soaked clothes after each bath is advised. Cleaning the ears after every bath is also necessary. Avoid sharing soaps and towels because of the danger of cross-infection.

Figure 2.2: Body washing

2. Oral Hygiene

- Our mouth is the area of the body most prone to collecting harmful bacteria and generating infections. Our mouth mechanically breaks food into pieces. This process leaves food particles that stick to the surface of our gums and teeth. Our mouth cavity is full of bacteria and is a good environment for bacterial growth. The decaying process quickly causes gum and tooth disease as well as bad breath.

- To prevent this undesirable situation, immediately after eating, the tooth should be rinse and brush your teeth with a fluoride-containing toothpaste twice a day before breakfast and before you go to bed or at least it is better advise to floss your teeth at least once a day, usually before you go to bed.

- The water used for rinsing the mouth can be clean water or water with a little salt dissolved in it. In situation where proper toothbrush is not available, traditional brushes such as twigs of selected trees can be effective substitutes particularly in rural settings if done carefully

Figure 2.3: Mouth cleaning

3. Hand Washing

- People should wash their hands before and after eating, after using the restroom/comfort room, or when their hands are visibly dirty/soiled (especially if contact with blood or bodily fluids has been made). Hand hygiene plays a critically important role in preventing this transmission.

1. Wash your hands and arms with soap and clean water.

2. Make sure to scrub in between your fingers.

3. If you have a brush, scrub your fingernails.

4. Rinse with clean running water.

5. Dry your hands in the air or use a clean towel. Do not touch anything until your hands are dry.

Figure 2.4 Hand washing procedure

- Hand washing facility can be made from locally available materials like clay pot and plastics by making hole and preparing stopper. Such hand washing facility can be hanged on outdoor, so that it will be easier for the family members to wash their hands and face after toilet visit, before and after meal or after contacting dirt material

Figure 2.5: Hand washing

- **A critical situation in everyday activity includes:**
  1. After using the toilet (or disposing of human or animal faeces)
  2. After changing a baby‘s diaper (bottom) and disposing of the faeces
  3. Before preparing and handling cooked/ready-to-eat food
  4. Before eating food or feeding children
  5. after interruption during food preparation
  6. After contact with contaminated surfaces (e.g. rubbish bins, cleaning cloths,)
  7. after handling pets and domestic animals
  8. After wiping or blowing the nose or sneezing into the hands (respiratory hygiene)

4 Face Hygiene (eye)

- Our face reveals our daily practice of personal hygiene. The most important area to keep clean is the eyes and nose.
- The eye discharges protective fluids that could dry and accumulate around the eye especially in the morning this organic substance can attract flies that carry trachoma and conjunctivitis.

- A person should wash their face every morning in order to remove all dirt that they have come in contact with during the course of the day. This will keep your face clean all day. Children are advised to wash their face frequently.

Figure 2.6:- Face washing

5. Fingernail and Toenail Hygiene (nail care)

- A nail is hard tissue that constantly grows. Long fingernails tend to accumulate or trap dirt on the underside. The dirt could be as a result of defecation or touching infected and contaminated surfaces. Keeping nails trimmed and in good shape weekly is important in maintaining good health.

6. Ear Hygiene

- Ear wax accumulates in the ear canal that leads from the outer ear to the ear drum. As the secretion comes out of the ear it collects dust particles from their Daily washing with soap and 29 | P a g e water is enough to keep the outer ear clean. Do not reach farther than you can with your little finger and other things into your ear for cleaning purposes might harm the ear.

7 Hair Hygiene (hair care)

- The scalp and hair should be kept clean by washing with soap and/or conditioner and warm water at intervals of a week.
- Poor hair hygiene could cause dandruff and skin infections such as Tineacapitis (korekor). Head hair is a good harbor for head lice and nits (eggs of head lice).
- Lack of sleep due to irritation caused by the parasites can also be a cause for irritation, inability to sleep and consequently poor health.

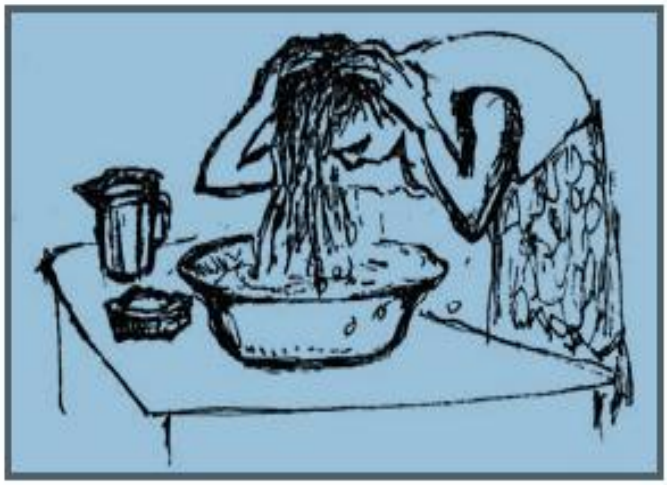

Figure 2.7: Hair cleaning

8 Foot Hygiene (foot care)

- Our feet sweat as we walk day and night and the sweat accumulates on all foot surfaces and between the toes. Sweating of the skin makes a good breeding site for spores of fungus infection called athlete‘s foot.
- When cleanliness of the toes is neglected, the bad odor generated has social consequences especially if you are working in an office with poor ventilation. The feet should be washed daily, or at least twice weekly.
- Foot hygiene is also important in the treatment of podoconiosis, sometimes known as mossy foot.
- It is a reaction in the body to very small soil particles that have passed through the skin of the feet. Podoconiosis can easily be prevented by wearing shoes at all times but, if someone is affected, careful washing and drying of the feet is an important part of the treatment.

9 Clothes Hygiene

- Clothes help to protect our body from cold and other conditions and to maintain warmth. We usually have two layers of clothing.
- The internal layer is underwear such as pants, vest and t shirt. These are right next to our skin and collect sweat and dead skin cells, which can stain the cloth. Underwear closes must be washed more frequently than the outer layer of clothing.
- Clothes that are not clean contribute to the multiplication of pests and the spread of pest borne diseases. Washing of dirty clothes requires adequate clean water, detergents (ENDOD‘) and washing facilities.
- Dressing clean clothes day and night is mandatory for better health. The sweat that comes from our body as dirt during activities accumulates on the body.
- Not hygienic close causes typhus, relapsing fever, bad smell, ulceration, etc. Therefore, keeping our clothes clean as we keep our body is very important.
- Frequency close changing mainly depends on the intensity of dirt on the clothes, and that depends on the climate and type of activity. However, it is advisable that the

frequency of changing is to be twice a week for internal wear and one time per week for outerwear.

Figure 2.7: Washing clothes in rural areas

10. Menstrual Hygiene

- Shaving of pubic hair is one of the main important parts for the genital hygiene. It helps to avoid the harborage of pests and make cleaning of the genital organ easier. Cleaning of genital areas can be done during general body cleaning or taking shower. But there are conditions where someone need specifically do cleaning of genital areas.

- **These are:**
  - **Before and after sexual intercourse**: this will keep the genital area clean and help to avoid from having bad smell.
  - **Ejaculation:** Sometimes men can ejaculate while they are sleeping. In this case it is important to wash it.
  - **During menstruation period**: females need to clean the genital area frequently during this period. Clean and soft cloths can be used in place of sanitary lady pads and it should be changed at four hours interval. Menstrual blood-absorbing items must be properly disposed of in a burial pit or other appropriate method.
  - **Before and after delivery**: Frequent cleaning of the genital organ before birth will give comfortable condition for the person in charge to deliver the mother. In addition, this helps to prevent the child from getting HIV infection. Since there is high fluid discharge frequent cleaning and caring after delivery helps the mother from developing offensive smell and probably infection.

Self check #2	Written test

I. Match the following question from column “B” to “A”

“A”	“B”
--------1. Eye hygiene	A. Diarrhea
--------2. Hair hygiene	B. Typhus
____ 3. Oral hygiene	C. Teeth decay
____ 4. Feet hygiene	D. Athlete‘s foot
____ 5. Hand hygiene	E. Trachoma
____ 6. Clothes hygiene	F. Tineacapitis

Note: Satisfactory rating 6 points unsatisfactory below 6 points

You can ask you teacher for the copy of the correct answers

Answer Sheet

Score _____

Rating _____

Name: _____ Date: _____

Short Answer Question

1._____

2._____

3. ----------

4. ----------

5._____

6._____

1.3. Environmental Health Hazards

1.3.1 Definition of Environmental Health Hazards

Environmental health safety is targeted towards preventing disease, creating health-supporting environments and encouraging positive human behaviors. Our environment consists of physical, chemical and biological factors and our relationship with our environment is always interactive. These interactions may expose us to environmental health hazards; that is any environmental factors that can cause injury, disease or death.

In this regard hazard and risk are different. A **Hazard** is something which is known to cause harm that is, a source of danger to health, while **Risk** is the chance or probability of the hazard occurring and the magnitude of the resulting effects (injury, disease or death). For example, if you climb a ladder you know there is a chance you could falloff and be injured, although it is unlikely. The ladder is the hazard and the chance of injury is the risk you take by climbing the ladder.

1.3.2 Categories of Environmental Health

1. Physical Hazards

- Physical hazards are those substances or conditions that threaten our physical safety. For example, Fires, explosive materials, temperature (hot or cold), noise, radiation, spills on floors and unguarded machines. Physical hazards also include ergonomic hazards which occur when the type of work, body position and working conditions put strain on your body. Short-term exposure in badly designed work may result in muscle fatigue or tiredness, but long-term exposure can result in serious long-term injuries of the musculo-skeletal system.

2. Biological Hazards

- Biological hazards are caused by pathogenic organisms or by products from an organism, which is harmful or potentially harmful to human beings. They include pathogenic bacteria, viruses and parasites, and also toxins (poisons) that are produced by organisms. Biological hazards are the cause of the majority of human diseases.
- **For example**, bacteria cause cholera, tuberculosis, leprosy, relapsing fever and many diarrhoeal diseases; viruses are responsible for hepatitis B and C, HIV, measles and polio; and there are many diseases caused by parasites. A parasite is any organism that lives on or in another organism, called the host, and causes damage, ill health or even death to the host. Some human parasites are external and live on the skin and hair, for example, mites that cause scabies. Internal parasites, living inside the body, include protozoa and helminths.
- Protozoan parasites are single-celled organisms that enter the body either by ingestion or via the bite of an infected insect. Malaria, sleeping sickness and leishmaniasis are examples of diseases caused by protozoan parasites introduced by insect bites; amoebic dysentery and giardiasis result from drinking or eating contaminated water or food.

- Helminths are parasitic worms that live inside the body. There are three main groups: tapeworms, roundworms and flukes. Tapeworms may be ingested with food, especially undercooked meat, or with water or soil contaminated with faeces.
- Roundworms, also called nematodes, are responsible for many different diseases including ascariasis, dracunculiasis, filariasis, hookworm, onchocerciasis (river blindness), trichinosis and trichuriasis. A type of fluke is the cause of schistosomiasis (bilharzias)
- Biological hazards arise from working with infected people, animals, or handling infectious waste and body fluids, as well as contact with unsafe water, food and waste. The hazards may occur in the home, at school or at working place.

3. Chemical Hazards

- Chemicals can be in the form of gases, solids or liquids states. Exposure to chemicals could cause acute health effects if taken in large quantities in a single dose; and chronic health effects if taken in small doses over an extended time.
- Detergents (powdered soap, bleaching powder), drugs and pesticides (DDT, Malathion, diazinon, Delta methrine) are chemical hazards that are commonly found in rural households. Incomplete burning of fuel releases carbon monoxide (CO) which is a chemical hazard. When breathed in, CO binds to the haemoglobin in our blood, reducing the uptake of oxygen; the cells of the body then suffer because they are not getting enough oxygen, this can result in severe sickness and even death.

4. Cultural/practice-related

- Hazards Culture is the knowledge, belief, value, art, law, morals, customs and habits that are acquired by people as members of society. It is also the common ways of life and set of thoughts and feelings shared by the members of a society.
- In general culture is both tangible and intangible resources of a community. Just as there are cultural practices that are good for health, such as breastfeeding a child, there are also cultural practices that adversely affect health and these can be considered to be cultural hazards.
- There are practices that are widely accepted and found in different areas of Ethiopia that can be hazards for health; the so called harmful traditional practices but not considered as culture.
- **For example**, the belief that evil spirits are the source of diseases, practices of storing drinking water uncovered, open defecation, not hand washing before meals and after latrine use. Hygiene and health promotion and community mobilisation are critical interventions that help improve practices that are not useful to the community.

5. Social Hazards

- Poverty and illiteracy are examples of social hazards. We know that poor and uneducated people get sick more frequently, compared to wealthier and more educated people. Alcoholism, obesity, smoking and drug abuse are also social hazards that affect our health.
- A person with such habits is, over time, degraded, not respected by society, physically and mentally dissatisfied, and ultimately is likely to suffer with chronic diseases such as lung and cardiovascular diseases.

1.3.3 Principles of Hazard Management

- Hazard management requires you to follow certain steps:

1. **Establish the context and identify the hazard:** to answer the following questions: What is the source of the hazard? Who is exposed? What are the pathways or activities that expose a person? What part of the environment is involved in the transfer of the hazard to humans?
2. **Hazard/risk analysis and evaluation:** Here you would analyse the risk and evaluate the potential of the hazard to cause damage to health. This step needs a deeper appraisal in collaboration with the Woreda health office, environmental health expert. The evaluation may require appropriate design, sampling and laboratory investigation.
3. **Communicate and consult:** When the hazards and risks have been determined, advice can be communicated on the interventions or control measures that are needed to control the hazard.
4. **Treat the hazard/risk:** The interventions or control measures are carried out by the person or people responsible for the hazard or risk.
5. **Monitoring and reviewing:** The implementation of interventions or control measures for the hazard must be followed up in order to determine whether they are successful.
6. **Record keeping:** Keeping records and reports on hazard management is always important. These records must contain the type of hazard, exposures and what control measures were taken

Self check #3	Written test

I. Match the following question from column “B” to “A”

“A”	“B”
--------1. Physical Hazards	A. carbon monoxide (CO)
--------2 Biological Hazard	B. Harmful traditional practices
____ 3. Chemical Hazards	C. Poverty
____ 4. Practice-related hazard	D. Noise
____ 5. Social Hazards	E. Pathogenic organisms

Note: Satisfactory rating 5 points unsatisfactory below 5 points

You can ask you teacher for the copy of the correct answers

Answer Sheet

Score _____

Rating _____

Name: _____ Date: _____

Short Answer Question

1._____

2._____

3. ----------

4. ----------

5._____

Information Sheet-4	Planning in personal hygiene and environmental health hazards

1.4. Planning in personal hygiene and environmental health hazards

- Environmental health planning refers to a systematic process by which goals are established, facts are gathered and analyzed, alternative proposals and programmes are considered and compared, resources are measured, priorities are established, and strategies and activities are designed to meet the established goals or objectives within a specified period of time.

1.4.1. Gaps identification

- You can use various tools in order to identify these problems.

1. Environmental health survey:

- ✓ This is a systematic survey using questionnaire.
- ✓ The questionnaire contains basic indicators of environmental health such as latrine availability, source of drinking water, waste disposal systems, cleanliness of the community, etc.
- ✓ You will need to do some statistical analysis (proportions and averages) to refine basic indicators of environmental health for your local context. You must be careful when designing a survey as it requires time, expertise and resources.

a) Rapid/quick assessment:

- ✓ The usual method that helps you gains a quick overview of the range of problems.
- ✓ The usual data collection tools that you can use for this are focused or group discussion, physical observation with checklists and interviewing key people.

- Finally generates a list of problems.

a) Reviewing of secondary data from reports, registration books etc.

b) Focus group Discussion:

- ✓ Facilitating environmental and personal hygiene problems with selected community members.

1.4.2. Priority setting

- It is difficult to handle all identified problems due to resource and other limitations;
- Therefore you need to consider the following criteria:

1. Magnitude of the problem (i.e. does the problem affect large number of people?)
2. Severity of the problem (whether the problem is deadly or not?)
3. Feasibility (i.e. effectiveness, cost and social acceptability of intervention)
4. Community concern (i.e. does the problem community felt need?)
5. Government concern (i.e. it must be relevant with health policy)

1.4.3. Developing Intervention plan

- Designing a health survey will need collaboration with others but your input is valuable for structuring the questions so they relate to local knowledge, attitude and practice (abbreviated as KAP).
- Interviews with the respondents, group discussion and observations are all useful for exploring the practice of personal hygiene.

- From the results of the survey you should be able to identify the priorities and interventions for improving personal hygiene in your community.

- You can then design a plan of action knowing the key themes that need to be covered:
  - ✓ Themes
  - ✓ Objectives
  - ✓ type of audience
  - ✓ Teaching aid
  - ✓ Place
  - ✓ Date
  - ✓ Responsible person

1.4.4 Identifying the audience

- There must be a good reason why you want to educate the community on personal hygiene.
- You should identify which group of people you want to target so that you can prepare appropriate health messages and teaching materials.
- School children, women, elders, adults, teenagers and patients seeking medical help are some groups that you might decide are priorities.

Figure 4.1: Children with hygiene education cards.

1.4.5 How to promote personal hygiene

- The most important point is that you must be prepared for the theme you want to cover.
- The preparation must focus on gaining detailed knowledge and adequate information on that theme. This requires reading materials, collecting appropriate teaching aids and knowing the audience (educational background, their needs, behavior, habits, etc.).
- Fixing the site, date and time is also important. You should identify the key messages you want to get across to your audience.

1.4.6 Implementing the plan

- Once the plan has been approved by the Kebele cabinet it can be implemented. Environmental health activities are put into practice on the ground at this stage.

1.4.7. Writing a planning report

- The recommended sub-titles are:
    1) Title of the plan
    2) Introduction or background
    3) Objectives
    4) Strategies and activities
    5) Indicators
    6) Resources (i.e. budget, human resource, and materials)
    7) Plan of action (i.e. activities by time and responsible person)

➢ You should prepare and present an annual plan of action for improvement of hygiene and environmental health to the kebele head.
➢ The plan of action needs careful consideration of your work in the kebele.
➢ The activities in the plan should include identifying problems, inspection services (households, food establishments, public utilities such as water sources, health facilities), hygiene promotion, monitoring selected indicators, sanitation promotion, training of local partners, sanitation campaigns and commemorating sanitation and water days.

1.4.8. Monitoring and evaluating the planned performance

➢ Daily, weekly or monthly monitoring will help you check the progress of the implementation, while evaluating performance at the end of the year is useful to help you see the overall progress

- Some of the methods evaluating described as follows.

1. The presence of hygienic hand washing procedures

    ✓ You should look for an instruction manual for hand washing procedures that should be available in public facilities (health post, health centre, hospitals).
    ✓ It's a good idea for the procedure to be posted on a wall where everyone can see it as an easy reminder.

2. Observation

    ✓ The easiest and most reliable method. In order to say if the surface of an object (body surface, eye, table top, floor, etc.) is clean or not,
    ✓ You should first understand what 'clean' means for those objects because the degree of cleanliness is judged in different ways.
    ✓ It may be clean or not clean; acceptable or not; or it may be categorized using a 5-point scale: not clean, somewhat clean, clean, very clean, and super clean.
    ✓ You have to understand that the degree of cleanliness may vary between your own and someone else's observations of the same object.

3. Indirect way of assessing

    ✓ You need to ask yourself why some infections are more prevalent in one village than another.

Self check #4	Written test

Direction: - I. Choose the correct answer from the given alternatives

1. Criteria for Priority setting

A. Magnitude of the problem B. Severity of the problem C. Feasibility D. All

2. Activities are put into practice on the ground at this stage

A. Implementation B. Monitoring C. Evaluation D. Assessment

Note: Satisfactory rating 2 points unsatisfactory below 2 points

You can ask you teacher for the copy of the correct answers

Answer Sheet

Score _____

Rating _____

Name: _____ Date: _____

Short Answer Question

1._____

2._____

1.5.1 Definition of Healthful Housing

- **Housing: -** is the physical structure that man uses for shelter and the environment of that structure including all necessary services, facilities, equipment and devices needed and desired for the physical and mental health and social wellbeing of the family and the individual. This definition is according to WHO.
- **Standard Housing: -** is a house that is properly planned and constructed, comfortable, safe to live in and fulfill the basic housing necessities (constructed in proper site, provided with safe and adequate water supply, safe and proper waste disposal, adequate light, space, well ventilated, etc.
  - ✓ In other word standard house fulfills the physical, mental and psychosocial needs of human beings.
- **Substandard Housing:-** is a house, which is poorly sited, planned and constructed, inadequate floor space for the family size (overcrowded), poorly maintained and does not in general comply with the more important sanitary facilities; this can be referred as Slum in urban case.
  - ✓ Poor housing and indoor environments cause or contribute too many preventable diseases and injuries, such as respiratory, nervous system and cardiovascular diseases and cancer. A degraded urban environment, with air and noise pollution and lack of green spaces and mobility options, also poses health risks.

1.5.2 Basic requirements of Healthful Housing

- Four basic requirements of housing :-

1) satisfaction of physiological needs
2) Protection against infection.
3) Protection against accidents.
4) Protection against psychological and social stresses.

1. Satisfaction of physiological needs

- Human physiology (the functioning of our bodies) is highly dependent on the immediate environment. Our environment should supply the necessary services and facilities for our physiological needs.

❖ Breathing

- Breathing is a physiological process that utilizes oxygen for energy production and expels the waste as carbon dioxide (CO2). Housing must allow adequate fresh air to get into the house and used air to get out. This ventilation of air is facilitated by a window.
- The area of the window surface through which air can pass must be proportional to the floor area of the room in order to get adequate air supply per given time. A guide of 10% (light and air admitting window area divided by floor area) is assumed to be adequate for residential housing

a) The floor dimensions of a room are 3 m wide and 4 m long.

- Calculate the size of the window that could supply adequate ventilation?
  - ✓ Floor area = 3×4 m = 12 m 2
  - ✓ **Answer -**The window should be 10% of the floor area. 10% of 12 m^2 is **1.2 m^2**.

b) The size of the window needed is therefore 1m wide by 1.2 m height if you had one window, or 0.8 m by 0.8 m each if you had two windows. Getting clean and fresh air through the window could be compromised by household activities.

- ✓ Interference with breathing due to smoke and gases from the use of fuels such as wood or dung is common. Inefficient combustion releases many toxic chemicals that can affect our skin, eyes and lungs.

❖ Seeing

- This is the ability to observe the immediate environment using our eyes. Naturally, visual physiology requires adequate light in order to effectively see or look at an object.
- Adequate light is also important for reading, watching TV and attending class lectures in a school. The physical structure of housing provides the required light through two sources: artificial light from electric sources and natural light through the windows from the sun. The minimum recommended light-admitting window area is similar to that for breathing.

❖ Sleeping

- Sleep is a time when our body must get complete rest in order to be refreshed for the next day. Sleeping requires a separate room and should be free from any disturbance such as noise and indoor air pollution.
- The housing structure should provide adequate space in the form of a bedroom that is reasonably free from any environmental hazard that could disrupt sleeping. Separate bedrooms for children and adults are, in many families, a necessity.

❖ Body heat regulation

- Housing helps us to regulate our body heat, which means it helps us to keep warm or to keep cool. The exchange of heat between our body and the immediate environment is dependent on the difference of temperature between the two. Relatively cold air is useful to take away excess heat through the process of convection.
- Convection is involved when there is a heat exchange between our body and relatively cold air moving across the body.
- Heat loss by conduction is involved when body heat is transferred to a colder surface by direct touch.
- The third mechanism for heat transfer is radiation, when body heat is lost directly to the immediate environment because of a temperature difference between two objects. Our housing should be suitable to help us regulate our body heat.

❖ Eating

- Eating food is linked with the digestive system of our physiology. A kitchen for food preparation and a separate space/room where a family gets together for meals are necessary to satisfy our housing needs for eating.

2. Protection against infection

- Healthful housing is essential for the prevention of a number of diseases;-
  a) Poor housing is associated with a wide range of diseases.
- Categories of communicable diseases due to poor housing include:
  - ✓ Diarrhoeal diseases (acute watery diarrhoea, dysentery, shigellosis, typhoid fever and other faeco-orally transmitted diseases) because of poor personal hygiene, absence or poor utilization of latrines and poor waste management.
  - ✓ Tuberculosis, measles and other droplet infections due to poor ventilation and crowding.
  - ✓ Acute and chronic lung diseases due to indoor/cooking smoke. Indoor smoke causes eye infection and irritation.
  - ✓ Skin infections such as scabies and ringworm due to crowding as a result of limited housing space.
  - ✓ Typhus fever and relapsing fever are possible due to crowding. Lice can easily travel from an infected person to the next nearby one.

- ✓ Disturbance of human comfort as a result of the bites of insects such as bedbugs and fleas. .
- ✓ Breeding sites of rats in poor housing.

b) We want to make sure that our housing provides the necessary service and facilities to ensure the prevention of communicable diseases and protection of our health.

3 Protection against accidents

- ➢ Poor housing can contribute to several types of accident including burns and electric shocks (if there is an electricity supply).

5.1:- Possible home injuries and their contributory causes.

Injury	Conditions that may cause the injury
Person falling over causing broken bones bruising etc.	Slippery floor; steps that are too high or too low
Building materials falling on people	Poor structure of roof and walls
Burn	Improper use of fuel; damage to electrical wires
Carbon monoxide poisoning	Not extinguishing fire sources while sleeping
Chemical poisoning (a child drinking pesticide, handling drugs, etc.)	Improper handling and storage of chemicals
Lack of air, breathing problems	No separate kitchen; keeping children close by while cooking with wood or dung fuel
Electric shock	Electrical wire is damaged byarat; incorrect installation; overloading a circuit etc.

4. Protection against psychological and social stresses

- ➢ Remember that housing was defined as more than just a shelter. Poor housing can contribute to psychological and social stresses. These stresses cannot be physically observed but they may be revealed in the words people use to describe how they feel. We know that stress is not good for a healthy person.
- ➢ **For example**, the absence of a school in a village can be a stressful condition for a family with school-age children. Poorly built housing or the absence of water in a household could be a source of stress. On the other hand, the presence of a church or mosque pleases those who want to have access to this opportunity.
- ➢ The presence of playgrounds for children, markets, kebele and police offices and recreational sites are some of the facilities that could alleviate human stresses.
- ➢ The satisfaction of psychological and social requirements through the presence of these facilities is very important to any organized village or community. These facilities are important for any existing as well as new settlements that include individual housing.
- ➢ The objective of a healthful housing programme is to satisfy all or most of the above basic requirements. Improvements can be suggested based on priorities. Poor housing sanitation, overcrowding, insufficient daylight, and poor ventilation are characteristics of tukuls in rural areas of Ethiopia.

1.5.3. Protecting people at special risk

- ➢ Handling the housing conditions of people who have been displaced because of war, flooding, earthquakes, ethnic conflicts and epidemics requires special consideration. This group of people is vulnerable to communicable diseases, physical and sexual abuse,

hunger, thirst and various types of injury. They are likely to be socially and mentally stressed.

- The provision of shelter (tents and other types of shelter), food, plenty of water and accident prevention is most important. The representatives of displaced populations can be organized into a committee to assist the facilitation of relief assistance. The government needs to have similar organization to work effectively

1.5.4. Characteristics of good housing

- Decreases risk of communicable diseases
- Fire hazards,
- Accident,
- Reduces the creation of slum and cost of municipal services.

1.5.5 Factors affecting Healthful Housing

- The main factors that affect the structure of housing
  - ✓ Poverty,
  - ✓ Education,
  - ✓ Climate,
  - ✓ Culture and population mobility
  - ✓ The size, shape and design.
- Various types of tukuls (rural housing) that reflect different climatic and cultural variations.

a) Big tukuls have tight-plastered walls and roofs, are more spacious and are usually found in cold areas.

b) Tukuls in pastoralist areas are smaller in size, easily constructed and relatively inexpensive.

C) Mobile populations require housing that can be reconstituted easily whenever needed.

- ✓ Some cultural values may hinder specific requirements such as the use of wider windows. Lack of education is also a problem.

d) Even in high-income households, poor knowledge of the links between housing and health may be a barrier to the construction of healthful housing.

e) You should note that these factors affecting housing conditions are broad issues and not something that anyone can tackle alone but you should be aware of these factors because they may be relevant in your villages

Figure 5.1 Structure of housing in different areas of Ethiopia.

1.5.6. Indoor Air Pollution

- Indoor air pollution refers to inefficient combustion and smoky fuels burned for cooking and heating are a troubling source of serious air pollution in many traditional and developing societies. The use of such fuels causes air pollution problems both indoors and outdoors.
- The quality of indoors air is a problem in many houses in developed countries because they were built to be airtight and energy efficient.
- Chemicals from burning fuels, smoking and other sources accumulate and create a pollution problem. Indoor air pollution is also a serious problem in many developing societies. In homes where open fires burn, especially when the climate is cold, the pollution from the fires accumulates and exposes the inhabitants, especially women, to the risks associated with smoke inhalation.
- Generally the most important indoor air contaminants are tobacco smoke, radon decay products, formaldehyde, asbestos fibers, domestic combustion products (such as carbon monoxide and carbon dioxide), and other chemicals used in the household.
- Women and young children suffer the greatest exposure. Indoor air pollution contributes to acute respiratory infections in young children (pneumonia), asthma, chronic lung disease and cancer in adults, and adverse pregnancy outcomes for women exposed during pregnancy. It may also can results cataracts, otitis media, poisoning and deaths.
- **For instance,** Carbon monoxide (CO) is a toxic gas that is given off in incomplete combustion, when fuels don‘t burn properly and it is very difficult for people to detect; this makes it very dangerous (may say silent killer).
- When we breathe in, oxygen is taken in through the lungs and carbon dioxide is breathed out. Hemoglobin in the red blood cells is used to carry oxygen to various parts of the body i.e. O2 + hemoglobin oxy haemoglobin; If there is carbon monoxide in the breathed-in air, it combines with hemoglobin more easily than oxygen does i.e. CO + hemoglobin carboxyhaemoglobin; CO reduces the oxygen-carrying capacity of the blood and poisons the body. It can lead to illness and even death.

Self check # 5	Written test

Direction: - Choose the correct answer from the given alternatives

1. Standard Housing is a house:-

A. properly planned B. comfortable C. overcrowded D. safe to live

2. Satisfaction of physiological needs A. Sleeping B. Eating C. Breathing D. All

Note: Satisfactory rating 2 points unsatisfactory below 2 points

You can ask you teacher for the copy of the correct answers

Answer Sheet

Score _____
Rating _____

Name: _____ Date: _____

Short Answer Question

1._____
2._____

Information Sheet#6	Promoting Institutional Hygiene and sanitation

1.6. Institutional Hygiene and sanitation

1.6.1. Scope of Institutional Hygiene and Sanitation

- An institution may be defined as any organization established for educational, social, religious, political, etc purposes.
- Institution accommodates a group of people at a time. Schools, health facilities, prisons, military camps are some examples of institutions. Institutions have certain basic characteristics in common that require careful planning, design, construction, operation, and maintenance.

▪ These include:

1) Appropriate site selection,
2) Accessibility to the community,
3) Proximity to sources of hazards such as noise and air pollution;
4) Accessibility to safe and adequate water supply
5) Availability of roads or transportation
6) Provision of facilities for the storage, collection, and disposal of all solid wastes generated in the institution

1.6.3. School hygiene and Sanitation

- When we say schools, we mean kindergartens, primary schools (first and second cycle) and high schools, all of which could be present in your locality.

Figure 6.1:-An elementary school in one of the rural areas of Ethiopia.

1.6.3.1. Components of school hygiene and sanitation

1. Health-related policies in schools

- All schools should be aware of the importance of school hygiene and sanitation for their students.
- Promotion of hygiene, organizing hygiene/health clubs, having a clean school compound and supervising classrooms for their cleanliness are some of the items that require the attention of the woreda and kebele school authorities. The implementation of policy statements must take into account the availability of human resources and materials.

2. Promoting hygiene

- Teaching students about health focuses mainly on the dissemination of hygiene information aimed at changing or modifying their behavior.
- Health information is usually incorporated within various school subjects such as science, biology, home economics and physical education. However, teaching aimed at changing the behavior of students is not part of the traditional education system. There are ways to fill this gap.
- Setting up and supporting health or hygiene clubs in schools, and the effective involvement of the Health Post, are important. You can take an active role in this by regular inspection and advising the school community in your area.
- You can take an active lead in coordinating and involving existing local health facilities in the promotion of school hygiene and sanitation.

3. Healthy school environment

- The physical and aesthetic values of the school environment and physical buildings need to satisfy the physical, physiological and psychological development of students.

❖ The important aspects of a safe and healthful school environment are:

- ✓ Adequate classroom space to avoid crowding. The Ministry of Health recommends: 2 m 2 per student at kindergartens; 1.11 m2 per student at primary school; 1.26 m2 per student at secondary schools.
- ✓ Classrooms with adequate daylight and ventilation; the proportion of window to floor area should be 25%.
- ✓ Classrooms that protect students' vision through the appropriate distance between the blackboard and the first line of seats.
- ✓ Dimensions of desks and chairs that match the students' physical development.
- ✓ The location of the school should be free from any potential physical and chemical hazards (e.g. free from noise and air pollution).
- ✓ Playing areas for physical exercise.

4. Provision of drinking water

- Many students may walk hours to get to school. The provision of safe water for drinking and personal hygiene is important and there needs to be adequate facilities in proportion to the number of students. The Ministry of Health advises 1 water tap for 50 students.
- Low-cost water fountains and water taps arranged in a water trough design are acceptable for schools. They should be mounted at the appropriate height from the ground surface to match the height of the students Water availability should be about five litres per day per student and water must be available throughout the school day.
- A water storage tank may be necessary to provide water reserves and satisfy the demand at peak hours.

- The sullage (wastewater) that results because of hand washing must be drained to a seepage or soak pit, or ditch.

Figure 6.2 Drinking taps and hand washing basin arrangements in a school.

5. Provision of latrines
   - The provision of latrines is also extremely important. In addition, separate latrines for girls and boys need to be provided to encourage girls to continue their education. The usual type of latrine at schools is communal dry pit latrine equipped with a vent.

❖ School latrines should meet the following requirements:

- ✓ They must be located away from the classroom in order to avoid interfering with the students' learning process. They must be reasonably accessible.
- ✓ They must be well-maintained and agreeable to use. They should provide privacy and security.
- ✓ The dimensions of the latrine must be adequate to accommodate the storage needs for 3–5 years.
- ✓ There must be hand washing facilities near the latrine. Handwashing with soap after using the latrine and before lunch must be encouraged.
- ✓ There should be separate latrines for male and female students. Latrines for teachers must be separated as well.
- ✓ There must be a bucket with water and a jug inside female latrines. This is essential for cleaning the bottom for female students during menstruation.
- ✓ In primary and secondary schools, there should be one latrine for every 30 students and one urinal for every 50 male students.
- ✓ Latrines should be hygienic to use and easy to clean. Students themselves should participate in daily cleaning of the latrine. The hygiene/health club should take the leading role in the maintenance of latrine cleanliness.

Figure 6.3 School latrines with water container and handwashing facilities.

6. Provision of solid waste management facilities
   - Discarded paper and cartons are the usual type of waste at schools. There could also be chemical wastes from school laboratories. Schools should have the following facilities: .
   - Waste bins/buckets in each classroom and teacher's office. Waste bins may be placed in the school compound where deemed necessary (around corridors, playgrounds).
   - Waste disposal pit at an appropriate location; a local incinerator can be used if the amount of school solid waste is significant.
7. Classroom sanitation
   - The cleanliness of the classroom is vital for a good learning process. Students should be involved in the maintenance of classroom cleanliness on a daily basis.
   - The floor of the classroom should be smooth to reduce dust. Dust and cracks in the floor must be avoided because these are good hiding sites for biting animals such as the chigger (also known as chigger red bug or harvest mite).

Figure 6.4:- Classroom sanitation: smooth floor, physical suitability of seats and desks, adequate light and ventilation.

1.6.4. Prison hygiene and sanitation
   - Detention homes such as prisons and jails, including temporary arrest facilities, must be hygienic. The transmission of communicable diseases such as diarrhoea, relapsing fever, scabies and typhus fever could be possible due to crowding and poor sanitation in prisons.

❖ The following provisions are important to check:
   - Sanitation promotion: the strict nature of the prison requires some form of local organisation that could be actively involved in cleaning the interior rooms and compound.
   - A sanitation committee can organise this with the guidance of the authorities of the prison. Its duty is to plan and execute a sanitation day at least once a week.
   - Room and compound cleaning, clothes washing and personal hygiene are some of the priorities to maintain the health of detainees. .
   - The presence of any possible epidemics in a prison must be checked through regular prison inspection.
   - Access to safe water, showers, and clothes washing stands, latrines and solid waste disposal facilities are essential in a prison. .

- An insanitary interior of the prison is attractive for insects such as cockroaches, fleas, lice and bedbugs. Inspection of new prisoners' clothing and bodies for the presence of these insects must be done when they arrive. High standards of personal hygiene through frequent body washing, maintenance of clean premises and clean clothes should be enforced.
- The rooms for detention should have an adequate supply of indoor light and fresh air. The surface area of windows should be a minimum of 10% of the floor area in order to admit daylight and adequate air.
- Overcrowding must be controlled as much as possible. Overcrowding leads to the transmission of many communicable diseases.
- Periodical hygiene education on selected relevant topics is important in order to maintain the healthy behaviour of prisoners.

1.6.5 Health facilities

- There may be different types of local health facilities in your area, such as health posts, private and public clinics and health centers.
- The benefit of health facilities is well understood. However, the risks associated with health facilities are not always well understood by patients and the general population. Health facilities generate infectious wastes, needles and other sharps that are potentially harmful.
- The possibility of acquiring infections is another concern. The sanitation provision that you have learned about healthful housing in Study Session 4 is also applicable in these institutions.

▪ In particular, you should be aware of the following requirements for the Health Post you are working in:

1) Healthcare waste must be properly segregated, collected and disposed of. Needles, other sharps, contaminated linen, gauze, cotton and similar items must be disposed of by burning. The ash and unburned items must be properly handled and buried in a designated pit.

2) Liquid and semi-liquid wastes (placenta, blood, vomit, secretions) must be disposed of in a placenta pit.

3) Waste handling facilities such as latrines, incinerator and placenta pit must be available, depending on the type of health services provided. Latrines should be clean, comfortable and pleasant to use.

4) Water supply and plumbing (water tank, hand washing facilities) are very important for good personal hygiene practice among health workers and patients.

1.6.6 Public offices

- Various offices are organized to serve the population, such as the kebele administrative office. It's important to maintain a healthy office environment for the benefit of the health of the civil servants.
- Particular requirements include well-lit and ventilated offices/rooms, latrines and proper solid waste management. The supply of safe water and hand washing facilities are important for the provision of personal hygiene.

1.6.7 Religious institutions

- Churches and mosques may be present in your kebele. The need for environmental health service to the church servants on one hand, and to the attending people on the other hand, is the point of concern.
- The provision of a safe water supply with its auxiliaries, and the development of latrines in agreed sites should have priority. Proper liquid and solid waste management are also important areas of intervention.

1.6.8 Mill house hygiene and sanitation

- You can find a mill house in almost every kebele. The basic principles of healthful housing are also applicable in mill house sanitation.
- The location of the mill house should not be a source of nuisance to the community such as from noise, flour dust and wastes. There must be adequate light and natural ventilation at the workplace. The provision of latrines, drinking water and waste management (solid and liquid waste) is important.
- The presence of hand washing and shower facilities is important for personal hygiene of the workers. Floor and walls should be easy to clean.
- The installation of an exhaust pipe for waste flour is necessary. The safety of workers must be maintained through the proper guarding of machines, provision of personal protective devices (head cover, goggles, boots, ear plugs or muffs, working clothes).

Self check # 6	Written test

Direction: - Choose the correct answer from the given alternatives

---------**1)** MOH recommends class room space for kindergartens school

A)1.26m^2 **B)**1.11m^2 **C)**2m^2 **D)**3m^2

---------**2)** The proportion of class room window for school **A)** 5% **B)** 10% **C)** 25% **D)** 75%

Note: Satisfactory rating 2 points unsatisfactory below 2 points

You can ask you teacher for the copy of the correct answers

Answer Sheet

Score _____

Rating _____

Name: _____ Date: _____

Operation Sheet #1	Performing hand washing

Steps for hand washing

1. Wash your hand and arms with soap and clean water.
2. Make sure to scrub in b/n your finger
3. If you have a brush scrubs your fingernails.
4. Rinse with clean running water
5. Dry your hands in the air or use a clean towel. Do not touch anything until your hands are dry.

LAP Test	Practical Demonstration

Instructions: Given necessary templates, tools and materials you are required to perform the following tasks within 5min.

Task 1: Perform hand washing

Instruction Sheet	LG17:- Establish and demonstrate community appropriate sanitation techniques

This learning guide is developed to provide you the necessary information regarding the following **content coverage** and topics:

- Introducing Concepts and Principles of Affordable Appropriate Technology
- Promoting Community Approaches to total sanitation
- Describing Approaches to communal behavior Change
- Identifying and preparing Sites for demonstration
- Assembling Appropriate demonstration materials
- Identifying Community group for the demonstration of new techniques
- Describing and elaborating the purpose, use and application of the sanitation techniques
- Identifying Standard Housing Components (SHC
- Recording and analyzing Activities implemented ad using for improving next implementation at facility level
- Compiling and submitting Reports to the responsible body

This guide will also assist you to attain the learning outcome stated in the cover page. Specifically, **upon completion of this Learning Guide, you will be able to**:

- Introduce Concepts and Principles of Affordable Appropriate Technology
- Promote Community Approaches to total sanitation
- Describe Approaches to communal behavior Change
- Identifying and preparing Sites for demonstration
- Assembling Appropriate demonstration materials
- Identifying Community group for the demonstration of new techniques
- Describing and elaborating the purpose, use and application of the sanitation techniques
- Identifying Standard Housing Components (SHC
- Recording and analyzing Activities implemented ad using for improving next implementation at facility level
- Compiling and submitting Reports to the responsible body

Learning Instructions:

1. Read the specific objectives of this Learning Guide.
2. Follow the instructions described below 3 to 6.
3. Read the information written in the information “Sheet 1, Sheet 2, Sheet 3 and Sheet 4”.

4. Accomplish the “Self-check 1, Self-check t 2, Self-check 3 and Self-check 4” **in page -6, 9, 12 and 14** respectively.
5. If you Learned a satisfactory evaluation from the “Self-check” proceed to “Operation Sheet 1, Operation Sheet 2 and Operation Sheet 3 ” **in page -15.**
6. Do the “LAP test” **in page – 16** (if you are ready).

2.1. Concepts and Principles of Affordable Appropriate Technology

- Primary health care is essential health care based on practical, scientifically sound and socially acceptable methods and technology made universally accessible to individuals and families in the community through their full participation and at a cost that the community and country can afford to maintain at every stage of their development in the spirit of self-reliance and self-determination."
- The Alma-Ata Declaration of 1978 was the first international statement emphasizing the importance of primary health care in reducing global health disparities. The Declaration defined primary health care as a collaborative effort involving all participants in the health system, from individuals and communities, to health providers, to national health services. The Alma-Ata declaration reaffirmed health as a fundamental human right, and set a target of bringing "Health for All by the Year 2000".

- **Intermediate Technology**
  - ✓ Simple
  - ✓ Effective
  - ✓ Cheap
  - ✓ Environmentally sound
  - ✓ Sustainable
- Appropriate Health Technologies (AHT)
  - ✓ Scientifically valid
  - ✓ Adapted to local needs
  - ✓ Acceptable to users and recipients
  - ✓ Maintainable with local resources
- Hard" and "Soft" Technologies
  - ✓ Hard technology employs engineering design, available materials and manufacturing equipment to bring about solutions that further self-reliance and determination.
  - ✓ Soft technology brings change by influencing individual and community decision-making behavior through social participation and action.
- Criteria for Appropriate Health Technologies
  - ✓ Effective, both in theory and in practical use
  - ✓ safe, and not easy to use incorrectly

- ✓ affordable, in initial and recurrent costs
- ✓ acceptable, to all who are affected by it
- ✓ sustainable, can be maintained, repaired and re-supplied

- Criteria for Defining Health Need
  - ✓ Magnitude of affected population
  - ✓ Level of morbidity and mortality caused by condition
  - ✓ Lack of appropriate technologies

- **Who Defines Needs and Solutions?**

➢ Users
- ✓ End users affected by health condition
- ✓ Health providers (public and private)

➢ Stakeholder involvement and endorsement
- ✓ Engaging the public sector
- ✓ Partnering with the private sector to advance market based solutions
- ✓ Donors

Self-Check -1	Written Test

Direction: - Choose the correct answer from the given alternatives

1. Criteria for Appropriate Health Technologies

A. Effective B. Safe C. Affordable D. All

2. Brings change by influencing individual and community decision-making behavior

A. Hard technology B. Soft technology C. Intermediate technology D. None

Note: Satisfactory rating 2 points unsatisfactory below 2 points

You can ask you teacher for the copy of the correct answers

Answer Sheet

Score _____

Rating _____

Name: _____ Date: _____

Short Answer Question

1._____

2._____

Information sheet # 2	Promoting Community Approaches to total sanitation

2.2. Community Approaches to total sanitation

- The term Community Approaches to Total Sanitation (CATS) to encompass a range of different community-based sanitation programmes. The aim of these approaches is total sanitation which means the complete separation of wastes from humans i.e. no open defecation and 100% of excreta to be hygienically contained. An important goal for villages and other communities is to achieve open defecation free (ODF)

❖ Essential elements of Community Approaches to Total Sanitation (CATS)

- CATS aim to achieve 100% open defecation free (ODF) communities through affordable, appropriate, acceptable technology and behavior change.
- CATS depend on broad engagement with diverse members of the community, including households, schools, health centres and traditional leadership structures.
- Communities lead the change process and use their own capacities to attain their objectives.
- Subsidies – whether funds, hardware or other forms – should not be given directly to households.
- CATS support communities to determine for themselves what design and materials work best for sanitation infrastructure rather than imposing standards.
- CATS focus on building local capacities to enable sustainability
- Government participation from the outset – at the local and national levels – ensures the effectiveness of CATS and the potential for scaling up.
- CATS have the greatest impact when they integrate hygiene promotion into programme design.
- CATS are an entry point for social change and a potential catalyst for wider community

Self-Check #2	Written Test

Directions: Say True or False

1. CATS depend on broad engagement with diverse members of the community.
2. CATS aim to achieve 100% open defecation free.

Note: Satisfactory rating 2 points unsatisfactory below 2 points

You can ask you teacher for the copy of the correct answers

Answer Sheet

Score _____
Rating _____

Name: _____ Date: _____

Short Answer Question

1._____

2._____

2.3 Approaches to communal behavior Change

- The methods introduce community mobilization and behavior change as their core principles to improve sanitation and integrate hygienic practices. Traditional methods of sanitation and hygiene promotion were teacher driven i.e. the educator taught by lecture and the community listened passively CATS approaches are demand-driven, community-led and emphasizes the sustainable use of user-friendly, affordable and safe sanitation.

❖ **Participatory Hygiene and Sanitation Transformation (PHAST**)

- **PHAST** is a widely-used community approach to hygiene promotion. It uses participatory techniques to promote good hygiene behaviors, sanitation improvements and community management of water supply and sanitation facilities. It is derived from a community appraisal method of health practice that, in the process, empowers community members (participants) to be able to identify their community problems.
- **Community appraisal** is a process for analyzing the existing community health problems by mapping water and sanitation and identifying good and bad hygiene behavior in relation to community hygiene practices and the spread of disease

Figure 3.1:- PHAST Community conversations. **Figure 3.2:-** PHAST participants looking at WASH mapping

❖ **Community-Led Total Sanitation (CLTS)**

- **CLTS** aims to bring community-wide elimination of open defecation by raising awareness and promoting affordable technology options. NGOs, multinational organizations and government health program in many countries in developing regions of the world (including Ethiopia) are adopting this approach. It has become the most successful community approach to total sanitation .The core principle of CLTS is a community-driven approach.

- The role of outsiders, possibly including you as a Health Extension Practitioner, is to guide the community to assess its sanitation situation, determine a strategy for improvement, implement the solution and develop way to measure success. CLTS relies on the skill of the facilitators using a set of activities and demonstrations to communities to study their Situation This includes open defecation patterns in their village and facea oral contaminate that occurs in their community.

Self-Check -1	**Written Test**

Direction: - Choose the correct answer from the given alternatives

1. **Community appraisal** is a process for analyzing the existing community health problems by mapping water and sanitation A. True B. False
2. **CLTS** aims to bring community-wide elimination of open defecation by raising awareness and promoting affordable technology options. A. True B. False

Note: Satisfactory rating 2 points unsatisfactory below 2 points

You can ask you teacher for the copy of the correct answers

Answer Sheet

Score _____

Rating _____

Name: _____ Date: _____

Information Sheet # 4	Identifying and preparing Sites for demonstration

2.4. Identifying and preparing Sites for demonstration

2.4.1 Preparation for the Demonstration

The preparation for the demonstration includes:-

1. . Selecting and preparing a class.
2. Developing directions for the demonstration.
3. Identifying the criteria and process by which a school will evaluate the demonstratio.
4. Providing the candidate with the learning objectives, written directions and evaluation criteria prior to the demonstration.
5. Submitting the lesson plan prior to the demonstration

1. Select and Prepare a Class for the Demonstration

- Preparation may include explaining the purpose of the lesson and providing guidelines on how students should behave during the lesson.
- The time of year will impact when and how the demonstration lesson is conducted. The selection team should consider any barriers and provide options for the candidate.

2. Develop Directions for the Demonstration Lesson

- The Selection Team should provide the candidate with written directions and guidelines at least three to five days prior to the scheduled lesson.
- If a district/school uses a standard lesson plan format, the team may want to send an electronic copy of the template to the candidate.

3. Identify the Criteria and Process by which the District/School will evaluate a Demonstration.

- The team needs to identify the criteria and process by which the demonstration lesson will be evaluated.

4. Evaluation Process

- The evaluation process of a demonstration lesson should take into consideration the procedures that team members will use during and after the demonstration lesson to evaluate the lesson.
- The process includes team members independently reviewing their notes of the observed lesson, rating the candidate's implementation of the lesson by a scoring system, and reaching consensus on the team's ratings of a candidate.

5. Candidate Submits Lesson Plan Prior to Demonstration

- The candidate should submit a lesson plan for the Demonstration Lesson to the Selection Team before the lesson. The team can indicate if the lesson plan should be submitted electronically before the day of the Demonstration Lesson or if a hard copy of the lesson plan should be provided the day of the lesson.
- The quality of the lesson plan should be a part of evaluation for the Demonstration Lesson. A district/school will need to determine the criteria prior to sharing this information with a candidate.

Self-Check #4	Written Test

Directions: Say True or False

1. The quality of the lesson plan should be a part of evaluation for the Demonstration.
2. The team needs to identify the criteria and process by which the demonstration lesson will be evaluated

Note: Satisfactory rating 2 points unsatisfactory below 2 points

You can ask you teacher for the copy of the correct answers

Answer Sheet

Score _____
Rating _____

3. Name: _____ Date: _____
4. Short Answer Question
5. 1._____
6. 2._____

Information # 5	Assembling Appropriate demonstration materials

2.5. Assemble appropriate demonstration materials

- Assemble Materials for latrine constriction

Self check # 5	Written test

Direction: - Choose the correct answer from the given alternatives

1. Materials for latrine constriction

A. Hammer B. Bucket C. shovels D. All

Note: Satisfactory rating 2 points unsatisfactory below 2 points

You can ask you teacher for the copy of the correct answers

Answer Sheet

Score _____
Rating _____

Name: _____ Date: _____

Short Answer Question

1._____

2.6. Identifying Community group for the demonstration of new techniques

- To achieve the goals of hygiene and sanitation as a HEW you should select appropriate target audience for each of your session.
- If you do not select appropriate target audience you will fail to achieve the targeted behavior change.
- All members of our communities can be target to hygiene and sanitation according to their need. However, as a HEW you should select appropriate topic for demonstration based on their need. The method you use also should fit with your targets.

❖ **Our demonstration targets are:-**

- Individuals such as clients of services, patients, healthy individuals
- Groups E.g. groups of students in a class, youth club, women's association
- Community E.g. people living in a village

A. Individuals

- All HEWs are expected to use demonstration to transfer health message to individuals within their community.
- **Individuals** are all health care service users such as hand washing procedure, women receiving antenatal care, school children, adolescents and young children. You will be able to deliver skill messages at both individual and at a household level.
- As a health extension practitioner will be able provide demonstration on personal hygiene, appropriate toilet utilization and ORS preparation. Through this activity you can reduce the transmission of the disease member of households and help patients on the way of getting relieve.

B. Groups

- Group is a gathering of two or more people who have a common interest.It is possible to plan educational programs among these peoples. There are two types of group. The first is **formal** groups who have definite purpose and interests, group leaders, commitment to meet regularly and take action, and in which members know each other.

C. Community

- Community can be described as a collection of people living in a defined geographical area and who have a feeling of belonging and share a common culture, beliefs, values and norms developed over a period of time.

- All demonstration activities should be based on good relationship with the community member. To build a good relationship the HEW should learn, understand and respect cultural norms and values in the community.

Self check #6	**Written test**

Direction: - Choose the correct answer from the given alternatives

1. Target for demonstration

A. Individual B. Community C. Group D. All

Note: Satisfactory rating 2 points unsatisfactory below 2 points

You can ask you teacher for the copy of the correct answers

Answer Sheet

Score _____

Rating _____

Name: _____ Date: _____

Short Answer Question

1._____

Information sheet #7	**Describing and elaborating the purpose, use and application of the sanitation techniques**

2.7 Describing and elaborating the purpose, use and application of the sanitation techniques

2.7.1 Simple pit latrine (Pit Privy)

- **Pit latrines also named as traditional latrine or pit privey.**
- **The types of latrines** are the simplest form of dry latrine and the most common used type of latrine in the community. They consist of a pit dug in the ground, squat hole, foot rest, squat cover and slab or floor above the hole.
- Pit latrines should also have an upper part, called the superstructure, to provide protection from the rain and sun, at the same time it provides privacy and comfort for the user.
- Pit latrines should also have an upper part, called **the superstructure**, to provide protection from the rain and sun, and privacy and comfort for the user.
- The excreta (faeces and urine) drop through the hole to enter the dry pit. Pit latrines should be constructed on a slight mound so they are higher than the surrounding ground and water at the surface will flow away from the hole.
- They should also have a lid that can be placed over the hole to reduce make using the latrine more convenient. The pit is often lined but the bottom remains open allowing the liquid to drain into the soil leaving the solids behind.
- Pit latrines can have a single pit or double pit. In double pits, one is filling with excreta the and second pit remains out of service. When the first pit is filled with excreta up to about 50 cm below the slab, it is taken out of use and the remaining space is filled with grass and vegetation materials that can be composted.
- You then use the second pit until that is full. Meanwhile, the first pit will stay sealed for a period of 6–9 month so that waste was decomposed and any pathogenic microorganisms also died.
- After this period, the material (humus soil) in the first pit can be taken out manually. (Humus or humic is used to describe organic matter that has been stabilized by decomposition processes.) It is safe to handle and readily used as fertilizer in agriculture or can be disposed of safely problems with flies and odors'.

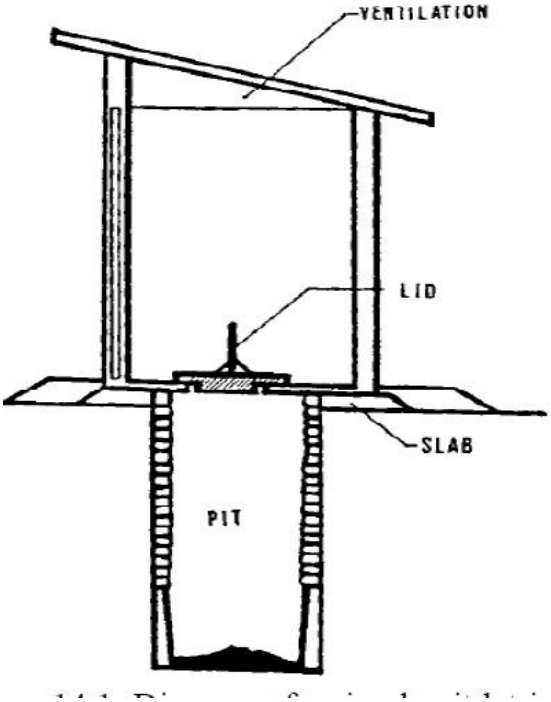

Figure 7.1: Diagram of a simple pit latrine

Figure 7.2: Pit latrine superstructures

- **Advantages and disadvantages of pit latrines**
  - ✓ It isolates human excreta from the surrounding environment and prevents the transmission of faeco-orally transmitted diseases.
  - ✓ It also does not require water so are appropriate in areas where there is no adequate water supply. Squatting is normal to many people and thus is acceptable to users.
  - ✓ Alternating double pits will allow the excreta to drain, degrade and transform into a nutrient-rich, safe humic material that can be used to improve soils.
  - ✓ It avoids contamination of surface water and top soil if properly installed and maintained.
  - ✓ It constructed with minimum cost using local material and local skills.
- ➢ There may be a foul odour from the pit and they can be a favorable place for the breeding of flies and mosquitoes. With single pits, a new pit needs to be dug every time when one gets full. They can be susceptible to failure/overflowing during floods.
- ➢ Use of excess water or less compostable materials for anal cleansing should be avoided because it may affect the decomposition rate of human excreta.

- **Sitting, designing and constructing a pit latrine**

- **The site of a latrine** should preferably be in the backyard of the house and away from an alley in the village. It should not be nearer than 6 m or farther than 50 m from the house.
- The direction of the wind should be away from the house. If there is a well in the compound, the latrine should be located as far away from it as possible and on the uphill side to avoid possible seeping and contamination of groundwater.
- The faecal microorganisms may migrate from the pit through the soil, however, the degree that this happens varies with the type of soil, moisture levels and other environmental factors.
- It is, difficult to estimate the necessary distance between a pit and a water source. Because it depends on the porosity of the soil types or soil texture and rock formations in the ground. Meaning that more porous soil needs more distance between latrine and water sources but 30-50m is the recommended minimum, with an absolute minimum of 15 m.
- The size of the pit depends on the number of people using it and the design period i.e. the length of time before it is full.
- Typically, the pit should be at least 3 m deep for a family of five for a design period of 3–5 years. The diameter should be at least 1 m; up to 1.2 m diameter will make it easier to dig but if it exceeds 1.5 m there is an increased risk of collapse.
- You need to consider the geology, soil type and topography (the slope of the land) when considering sanitation technologies.
- In flood-prone areas, it is advisable to raise the mound of the latrine and prepare diversion ditches around it. But the soil conditions rocky and it is impossible to dig a deep pit, the depth of the pit can be extended by building upwards with concrete rings or blocks.
- Care must be taken to ensure the structure remains watertight. The level of the water table must also be taken into consideration. The pit must be entirely above the water table at all times of the year.
- If the water table is near the surface of the ground, the waste in the pit may contaminate the groundwater. Lining the pit prevents it from collapsing and provides support to the superstructure. The pit lining material can be brick, rot-resistant timber Concrete, stones, or mortar plastered on to the soil. The bottom of the pit should remain unlined to allow the percolation of liquids out of the pit.

- The superstructure should be built using locally available materials. However, the type of superstructure depends on several factors such as the household‘s financial capacity, the availability of construction material locally, local customs and traditions, and the availability of skilled artisans.

Figure 7.2: (a) Slab with raised footrest in a pit latrine. (b) Round cement slab

❖ **Maintenance of pit latrines**

- You should advise families to keep the squatting or standing surface clean and dry. This will help to prevent pathogen/disease transmission and limit odors’.
- If the pit has been dug to an appropriate size for the number of users, then it may never become full. The liquid will drain into the soil and the solid waste will slowly decompose so the volume remains stable.

2.7.2 Ventilated Improved Pit (VIP) latrine

- The type of latrine that have an improvement over the simple dry pit latrine.
- The distinctive feature of the VIP latrine is that the vent pipe installed into the pit, which is used to exhaust the foul odour from the pit due to a continuous flow of air comes in through the superstructure and enters the pit through the hole.
- The cold air will go down into the pit displacing (pushing up) the hot smelly air upward through the vent pipe and the vent also control flies. A **mesh screen** tied at the top of the vent pipe will prevent flies from escaping to the outside of the latrine with a hole size of 1.2–1.5 mm have proved to be the most effective.

- VIP latrines can have a single pit or double pit. They share the advantages of simple pit latrines with slabs described above but they also have unique advantages that it significantly reduces flies and odors. Even though the health risks from flies are not completely removed by ventilation.

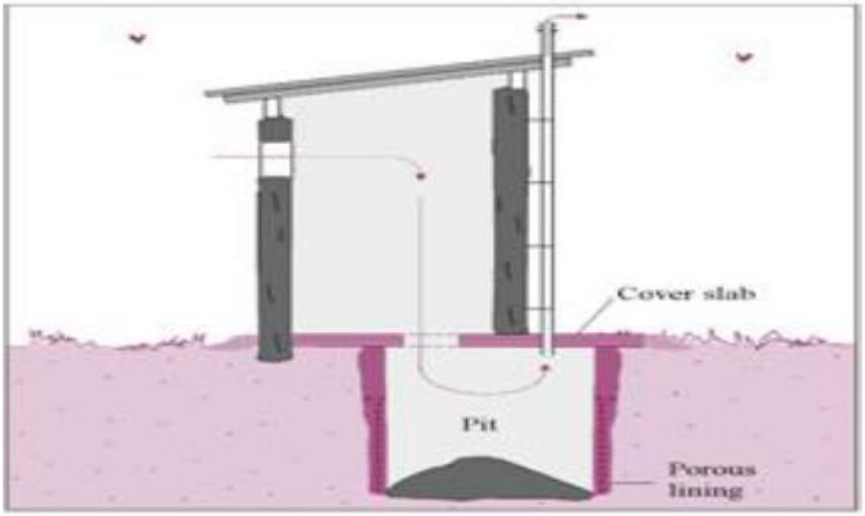

Figure 7.3: If you look back at the photos in this study session, you can see vent pipes in several of the latrines.

- **Constructing a VIP latrine**
  - As we have discussed the improved features of VIP latrines. The vent pipe should have an internal diameter of 110–150 mm and reach more than 300 mm above the highest point of the Superstructure.
  - The vent works better in windy areas but where there is not much wind its effectiveness can be improved by painting the pipe black. This makes the vent pipe warmer and the heat difference between the pit (cool) and the vent (warm) creates an updraft that pulls the air and odors up and out of the pit.
- **Maintenance of VIP latrines**
  - The maintenance requirements are similar to simple latrines.
  - Dead flies, spider webs, dust and debris should be removed from the ventilation screen to ensure a good flow of air.

2.7.3. Spring Protection (SP)

- There may not be many opportunities to develop new spring sources but, if the opportunity does arise, there are certain procedures to follow to ensure the spring water is protected and safe to drink.
- You would be working with others if a new spring source was to be developed but the same principles will apply to existing spring sources because the protection needs to continue to work into the future.
- Before using a spring, a thorough sanitary survey needs to be carried out at the site to assess the quantity and quality of water and the possible contamination.
- If the results of the sanitary survey are satisfactory, the eye of the spring (the point where the water emerges from the ground) should be located by digging out the area around the spring down to the impermeable layer.

- **Different types of spring protection can be constructed but in general they are as follows.**
  - A concrete waterproof protection box, also known as a spring box, should be constructed over the spring to prevent all actual and potential sources of contamination.
  - A retention wall in the front part of the protection box should be constructed to keep water flowing to the delivery pipe. You can see the retention wall of this spring with the delivery pipe emerging from it.
  - In some situations, if the flow is not constant, a collection box may also be constructed in order to ensure adequate water storage. The intake and overflow pipes should be screened to prevent the entrance of small animals.
  - The spring and collection box, if there is one, should have a watertight top, preferably concrete. Water will move by gravity flow or by means of a properly installed mechanical pump.
  - An inspection hole should be tightly covered and kept locked. Springs should be protected from flooding and surface water pollution by constructing a deep diversion ditch above and around the spring.
  - The ditch should be constructed so it collects surface water running towards the spring and carries, or diverts, it away. It needs to be deep enough to carry all surfaces water away, even in a heavy rainstorm. The surrounding area should be fenced to protect it from animals

Figure 7.4: A protected spring. Note the concrete retention wall with two delivery pipes and the surrounding fence.

2.7.4. Well Protection (WP)

- Before and during water source development care should be taken to minimize possible risks. The well should be located on a higher level than possible sources of contaminants such as latrines and cesspits (a pit for collection of waste matter and water especially sewage).
- The liquid from the pit may seep into the surrounding ground and into the groundwater. If the latrine is higher up a slope than the well then the contaminated groundwater is likely to flow downwards and into the well.
- The natural flow of the groundwater (the hydraulic gradient) should be away from the well and towards the sources of contaminants, and not the other way round. In normal soils, the minimum distance between the well and the source of contaminants should never be less than 15 meters and a distance of 30–50 m is recommended. However, for limestone and some other soil formations this distance need to be greater because groundwater can pass very easily through some rocks and soils.
- The inside wall of the well should be made waterproof by constructing a well casing.

- In small diameter bored wells, the casing can be a pipe but in larger wells, the casing needs to be constructed by cementing from the top of the well down to a minimum depth of 3 meters.
- The casing of the well should also be extended for a minimum of 60 cm above the surrounding ground level to prevent the entrance of surface runoff. A concrete cover should be fitted over the casing to prevent dust, insects, small animals and any other contaminants from falling.
- A pump should be installed, but if a pump is not available then a sanitary bucket and rope system may be used. The immediate area of the well should preferably be fenced to keep animals away
- The area surrounding the well should be graded off i.e. should be sloped away from the well, in order to prevent the flow of storm water into the well.

Figure 7.5: Two wells with concrete protection.

2.7.5. Standard Housing Components (SHC)

- Healthful housing can be affected by Poverty, education, climate, culture and population mobility. Those are the main factors that affect the size, shape and design of housing.

❖ **Standard housing should be fulfill the following requirements:**

1. Location of housing

- The location of housing must be free from flooding and any potential natural disaster.

2. Size of housing

- Based on the requirement to satisfy physiological needs, a minimum of 9–10 m2 with 2 m height per individual is advised. This square unit is adequate for all purposes and services that our body needs.

3. Type and size of rooms

- Rooms for sleeping (bedroom), eating meals (dining room or salon) and storage (store room) are important. Sleeping rooms for children and adults should be separate if possible. Animal sheds and kitchen must not be part of the main rooms (sleeping and salon), but should be placed outside. Partitions up to the ceiling can be used to create separate areas within the house.

❖ **Based on the available literature, the space requirements are as follows:**

- ✓ A living room (dining room or salon) 3–5 m2 per person
- ✓ Bedroom at 5–6 m2 per person, with a minimum room area of 8–12 m2
- ✓ Kitchen (greater than or equal to 7 m2)
- ✓ Store (5 m2)

4. Windows

- The proportion of window surface area to floor area must be 10% at minimum. For instance, if the floor size of a room is 16m2 (4mx4m). The window size should be 10%x16m2. This gives 1.6 m2
- It is good to locate the window facing to south, south-east or south-west so that adequate sunlight can be possible throughout the day. The presence of two windows is advisable for effective ventilation; especially in the health posts (health facility)

5. Structure of the walls

- Walls must be well plastered with local materials both on the interior and exterior. Smooth interior walls are less likely to harbor insects such as bedbugs and cockroaches and others.

6. Kitchen

- The kitchen must be totally separate from the main house. It must have an improved stove with a chimney for cooking injera and other foods.

7. Latrines and hand washing facilities

- Good housing has a latrine and hand washing facilities to maintain personal hygiene and the prevention of infections at the appropriate site .Appropriate site means a site which selected in terms of distance from water sources, kitchen, residential home and wind direction

8. Cleanliness

- The interior of the dwelling and the immediate environment must be clean. Any type of solid waste, sewage or liquid waste and faecal matter must not be seen within and around the house.

Self check # 7	Written test

Direction: say “True” or “False”

1. The proportion of window surface area to floor area must be 10% at minimum.
2. The distance between the well and the source of contaminants should be 5–10 m is recommended.
3. The distinctive feature of the VIP latrine is that the vent pipe installed into the pit.

Note: Satisfactory rating 3 points unsatisfactory below 3 points

You can ask you teacher for the copy of the correct answers

Answer Sheet

Score _____
Rating _____

Name: _____ Date: _____

Short Answer Question

1._____

2._____

3._____

Information sheet # 8	Recording and analyzing Activities implemented and using for improving next implementation at facility level

2.8 .Recording and analyzing Activities implemented and using for improving next implementation at facility level

- In reporting your health-related activities, you need to collect information that will tell you how well you have done in terms of your targets, and compare this information with the things you planned to achieve.

❖ Some of the sources of information available to you include:

- Examining records: for example health service records, financial and administrative records.
- Documentation: for example letters, reports, plans, attendance lists, forms, invoices, receipts, minutes of meetings and official reports.
- Continually observing work progress, staff performance and service achievements.
- Discussing progress and any problems with staff and with the community.
- Standard reporting formats, such as tally sheets, need to be designed to collect health information data from the client or patient records.
- Standardization of the reporting format is usually done by the Ministry of Health or Regional Health Bureau. However, as a Health Extension Practitioner you may need to develop some data collection forms yourself so that you can collect information about the work that you and your team are doing.
- In order to obtain a comprehensive picture of the health status of people in your community, information from additional sources may be needed. Young should always have a notebook to collect data as you go about your work
- It may also be necessary to collect extra information from sources such as non-governmental (NGO) community-based organizations and nearby health facilities. For example, if a community-based organization trains peer educators on social mobilization, or provides services for orphans and vulnerable children, you should collect this information from them so that you can report to the next level about your community health services as a whole.
- Information obtained from monitoring can be used to identify day to da problems, as well as for regular planning of the health work in your community. It is essential to be aware of the significance of the information you collect and to be confident of its

correctness. Records must be reviewed at regular intervals and information must be verified.

- You may be able to confirm the accuracy of your records by asking questions such as:
  - ✓ Is the programme or service operating as needed?
  - ✓ Are the volunteers completing the model household checklists correctly?
  - ✓ Is training of model households being carried out as intended?
  - ✓ Does the Health Post receive adequate vaccination kits?

Self check # 8	**Written test**

Direction: say “True” or “False”

1. In reporting your health-related activities, you need to collect information that will tell you how well you have done.
2. Health Extension Practitioner you may need to develop some data collection forms by yourself.

Note: Satisfactory rating 3 points unsatisfactory below 3 points

You can ask you teacher for the copy of the correct answers

Answer Sheet

Score _____
Rating _____

Name: _____ Date: _____

Short Answer Question

1._____

2._____

Instruction Sheet	LG18:- Provide environmental health services

This learning guide is developed to provide you the necessary information regarding the following **content coverage** and topics:

- Promoting Solid and liquid waste management
- Promoting Healthcare Waste Management
- Promoting Latrine Construction
- Educating Latrine Utilization Changing Attitudes and Behavior
- Educating Public Health Importance of Vectors
- Introducing Water supply Safety
- Introducing Water associated diseases
- Promoting Treatment of Drinking Water at Household and Community level
- Promoting Community Drinking Water Source Protection
- Introducing Water pollution and its Control

This guide will also assist you to attain the learning outcome stated in the cover page. Specifically, **upon completion of this Learning Guide, you will be able to**:

- Promote Solid and liquid waste management
- Promote Healthcare Waste Management
- Promote Latrine Construction
- Educate Latrine Utilization Changing Attitudes and Behavior
- Educate Public Health Importance of Vectors
- Introduce Water supply Safety
- Introduce Water associated diseases
- Promote Treatment of Drinking Water at Household and Community level
- Promote Community Drinking Water Source Protection
- Introduce Water pollution and its Control

Learning Instructions:

1) Read the specific objectives of this Learning Guide.
2) Follow the instructions described below 3 to 6.
3) Read the information written in the information “Sheet 1, Sheet 2, Sheet 3 and Sheet 4”.
4) Accomplish the “Self-check 1, Self-check t 2, Self-check 3 and Self-check 4” **in page -6, 9, 12 and 14** respectively.
5) If you Learned a satisfactory evaluation from the “Self-check” proceed to “Operation Sheet 1, Operation Sheet 2 and Operation Sheet 3 ” **in page -15.**
6) Do the “LAP test” **in page – 16** (if you are ready).

Information Sheet-1	Promoting Solid and liquid waste management

3.1 Solid and liquid waste management

3.1.1. Definition of terms

- **Waste management**: - refers to the many methods and processes of dealing with waste at every stage from generation and collection through to final disposal. Waste needs to be managed in order to prevent contact with humans or their immediate environment.

✓ The main purpose of waste management is to isolate waste from humans and the environment, and consequently, safeguard individual, family and community health. In addition, the aesthetic value of a better outlook and a clean physical environment is important for our emotional wellbeing.

✓ The waste we produce can be categorized as liquid waste or solid waste depending on its physical state. It can also be categorized as hazardous or non-hazardous.

- **Waste: -** is generally refers to any unwanted substance that excreted in to the human environment either in liquid form or in solid form from different sources.
- Those excreted in liquid form you can consider as liquid waste even though they have a number of different identification characteristics from each anthers while those excreted in solid form can be considered as solid waste
- **Sullage (Grey water):-** is the waste water that don't contain human waste, And it usually arises from domestic activities such as waste water arises from washing in the bathing room, kitchens during food preparation and dishwashing
- **Sewage (black water):-** is the liquid waste that contains a mixture of waste water with human waste, And it can be called as the liquid waste that follow through the sewer
- **Human waste:-** is the waste that excreted from human body either in the urine or faeces forms
- **Runoff**:- is the liquid waste that created by rain fall collection on the ground,
- **Effluent**:- is refers to the out flow of liquid waste from the source it generated
- **Influent**:- refers to the is inflow of liquid waste
- **Sewerage :**-refers to the network of pipes for collecting or connecting from one station to anther station
- **Sludge: -** is the digested waste matter.
- **Biodegradable: -** is a biological digestion process by which microorganisms, particularly bacteria, decompose the organic matter.
- **Anaerobic bacteria**: - is the decomposing bacteria not require oxygen.
- **Liquid waste management**: - refers to the activities that carried out in order to make a liquid waste safe to the human environment through providing proper facilities and services for a safe disposable of waste.

3.1.2 Principles and Concepts of Waste Management

- **Public health importance of waste**

- Affect the health and comfort of individuals in rural Ethiopia where municipal, or onsite, facilities do not exist or are not functional.
- Lead to environmental pollution.
- Encourage the breeding of disease-vector, animal scavengers and rodents.
- Result in a range of diseases through different routes of exposure such as faeco-oral and soil transmitted mechanisms.
- Public or community nuisance due to foul odour and unsightliness of open defecation faecal matter and openly dumped solid wastes.
- Obstruction of drainage systems leading to creation of favorable conditions for disease vector breeding sites.
- Fire hazards.
- Psychological health hazards

3.1.3 Liquid wastes Management

- **Source**

I. The liquid waste classification based on its content

a) **Hazardous liquid waste:-** is the type of liquid waste that contains a disease causing pathogen [e.g. bacteria, viruse] or chemicals that cause adverse health effect

b) **Non hazardous liquid waste**:- is the liquid waste that don't contains disease causing pathogens

II. Liquid waste classification based on its source

a) Residential [domestic] liquid waste:- is the liquid waste that generated from households. It mostly considered as non hazardous liquid waste e.g. kitchen

b) Commercial liquid waste:- are the liquid wastes that generated from commercially established area of food and drinking established area, and from commercial area

c) Industrial liquid waste: - is the liquid waste that generated from industrial factories, it vary depending on the type of industries of which the materials used [inputs] and the process taken.

- ✓ It may be toxic, and hazardous in nature or can be contains Non hazardous substances. There for, it is unlike to anther liquid waste , it requires special treatment before discharging from area generated[industry]

d) Institutional liquid waste: - is the liquid waste that generated from public, private, governmental and Nan governmental institution, offices, health facility, schools, universities, religious institutions.

- **Methods liquid waste disposal**

- **The basic requirements expected from a human waste (excreta) disposal method are:**

- ✓ Surface water must not be contaminated.
- ✓ There should be no contamination of groundwater that may, in turn, contaminate springs or wells.
- ✓ Excreta should not be accessible to flies or other animals.
- ✓ There should be no handling of excreta; where this is unavoidable, it should be kept to a minimum.
- ✓ There should be no odours or unsightly conditions.

- ✓ The method used should be simple and inexpensive in construction and operation.
- ✓ The method should last for at least 5 years to be cost-effective

1 Human waste management

- ✓ The sanitation technologies that are used for human waste management are:-

a) The most usual method of onsite liquid waste containment in rural Ethiopia is the pit latrine.

- ✓ Pit latrines are simple **drop and-store systems** in which the liquid waste collects in a pit below. There are many different designs of pit latrine

Figure 2.1:- A traditional pit latrine. **Figure 2.2:-** Ventilated improved pit (VIP) latrine.

b) W.C.s and pour-flush facilities were classed as wet or water carriage systems, also called drop-flush-and-discharge systems.

- ✓ **The aqua privy** or water privy is another in this group. Aqua privies consist of a latrine constructed above a watertight tank containing human waste and water. The wastewater from these systems is usually discharged to a septic tank or to sewers which carry it to a liquid waste treatment plant.
- ✓ The presence of adequate water is essential for all wet systems. For this reason, and also because of the cost involved, they are not recommended in most rural places where there is inadequate running water. For such areas, the recommended methods of sanitation are dry or non water carried systems where there is no water needed to carry the waste offsite.

Figure 2.3:- Pour-flush latrine **Figure 2.4:-** Water closet (W.C.) toilet.

2. Runoff management

- ➢ Runoff or storm water is the liquid waste that created by rain fall collection on the ground, it needs to be properly managed to ensure it even though it does not have a damaging impact on property or health, but may cause physical hazard to the community of rural.
- ➢ In rural area preplanning to effectively prevent run off from entering households and public buildings for effective runoff management.

3. Sullage management

- The Sullage has been discharged to sewers or septic tanks in areas where they exist. However, in many rural areas there is no sewer system so it is necessary to construct a pit near the household to dispose of sullage properly.
- The pit should be filled with gravel or sand and the sullage can be allowed to percolate into the ground.
- A sullage pit keeps the wastewater in one place and encourages it to soak quickly into the ground. It also avoids bad odour and unsightliness in the environment.
- Which vectors do you think might be encouraged by sullage collecting on the ground? Mosquitoes are likely to be attracted as they use stagnant water as breeding sites. Flies and rats might also appear as the sullage would be as source of drinking water.

4. Industrial wastewater management

- Effluent produced by an industry should meet the national guideline values of wastewater quality before it is released into rivers, streams or even municipal sewer systems. However, it is beyond your mandate to check it but if you have any concerns, you should request inspection by experts such as and environmental health officers in the district or higher administrative bodies.
- In your role as a community health worker, you can assist a relevant expert by providing the necessary information to your immediate supervisor to facilitate the enforcement of environmental law in your locality. You are not expected to take actions by yourself. Public health complaints by community members should also be communicated to the relevant officers for timely action.

5. **Collection, storage and treatment of liquid waste**

1 .Septic tanks

- Septic tanks are used with water carriage sanitation systems. The human waste is washed into the tank where it is stored and partially treated.
- A septic tank is a watertight chamber, usually made of concrete, and is mostly under the surface of the ground. They have inlet and outlet pipes. Fiber glass, PVC or plastic tanks can also be used.
- The retention time of the wastewater in septic tanks should be a minimum of 19 hours but can be a great deal longer.
- The purpose of septic tanks is for the solids to settle out of the wastewater and for anaerobic decomposition of organic solids to take place. However, the treatment in a septic tank is only partial.
- The solids will be broken down in the tank and diluted in the wastewater but this will still contain high levels of organic pollutants.
- Septic tanks should only be used in places where water is plentiful and where vacuum trucks are available to remove sludge periodically from the chamber.
- The process of removing sludge from the septic tanks is called **desludging.**
- **A septic tank has the following advantages:**
- Can be built and repaired with locally-available materials.
- Has a long service life.
- Presents no problem of flies and odour, if properly used.

- Has a relatively low capital cost (though it may not be affordable by rural households), and moderate operating costs.
- Does not require electrical energy because it uses gravity flow.
- **The constraints of a septic tank include the following:**
- Only applicable for water carriage sanitation systems.
- Treatment is only partial and the effluent may still contain pathogens.
- Sludge must be removed periodically.

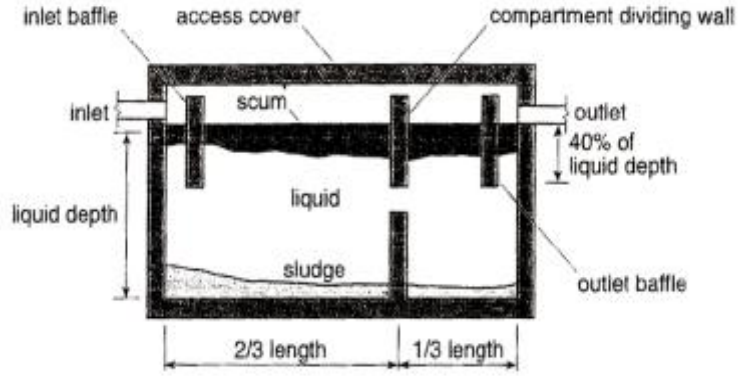

Figure 2.5:- Diagram showing the typical internal structure of a septic tank.

2. Seepage pit

- Septic tanks are a storage and treatment unit to complement such facilities as W.C.s (cistern flush toilets), pour-flush toilets and aqua privies.
- The effluent from septic tanks is usually piped into a soak pit, also known as a seepage pit.
- A seepage pit is lined with open-jointed or porous material such as bricks or stone without mortar that allows the wastewater to seep out slowly into the soil. Alternatively the wastewater may be spread across a drainage field using an array of pipes buried below the surface.

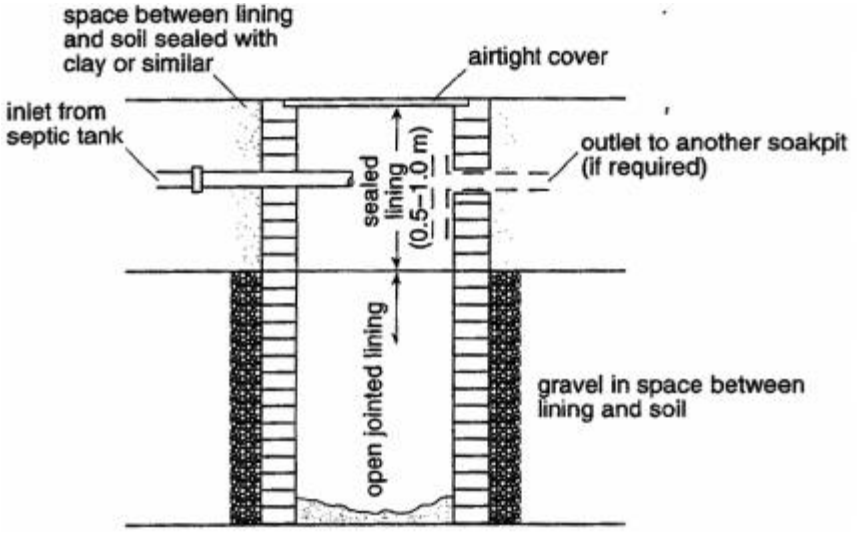

Figure 2.6:- Diagram of a seepage pit.

3. Anaerobic biogas reactor

- An anaerobic biogas reactor, also known as an anaerobic digester, uses anaerobic digestion to convert liquid wastes and other organic matter into sludge and biogas.
- The sludge can be used as a soil fertilizer and the biogas can be used for energy to produce heat (for use in cooking) or electricity. This affordable technology can easily be adapted by rural families and communities if appropriate training is given to local artisans and masons in the design and construction of the reactor.
- The reactor consists of a chamber usually below the ground. It has an inlet for inputs (mainly human excreta) and two outlets (one at the centre for biogas, and the other on one of the sides for outlet of sludge). Addition of animal manure and vegetation will improve the efficiency of the reactor.
- Neighborhoods' can join together to share a digester. However, if sufficient wastes are generated, individual households can each have one and get the benefit of biogas production. You should explore if local loaning enterprises could help households install an anaerobic biogas reactor.

Figure 19.6:- An anaerobic digester under construction

6. Centralized wastewater treatment systems

- This system of liquid waste management can be functional in larger towns and cities, in the centralized waste water treatment the liquid waste may be conveyed via a sewerage network to a centralized wastewater treatment plant, for example, Addis Ababa.
- This method is not likely to be used in rural and peri-urban areas of Ethiopia. In addition to sewage, industrial waste may be discharged into the sewerage network, although it may have to have special treatment (technically called, pre-treatment) onsite beforehand.

3.1.4 Solid wastes Management

- **Sources and types of solid wastes**

a) The solid waste classification by source

1) Residential solid waste is the waste that generated from residential house e.g. domestic solid waste
2) Agricultural solid waste is the waste that generated from agricultural origin.
3) Commercial solid waste is the waste that generated from commercial area.

4) Institutional solid waste is the waste that generated from institution which is governmental [private] institutions e.g. the waste that generated from the school, food and drinking establishment.
5) Health care solid waste is the waste that generated health care facilities e.g. the solid waste that generated from hospitals.

b) The solid waste classification by its content

- Infectious solid waste is the solid waste that contains a disease causing pathogens e.g. bacteria, viruses (about 10% of the total waste).
- Non infectious solid waste is the solid waste that doesn't contains a disease causing pathogens (about 90% of the total waste).

c) **The solid waste classification by its putrescibility**

- Putriscible solid waste is the solid waste that easily decomposed or biodegradable
- Generated by growing, handling, preparation, cooking and consumption of food. These wastes tend to be more abundant during the summer (rainy) season.
- Non- putriscible solid waste is a solid waste that don't decompose easily or non biodegradable Wastes do not decompose easily; they may or may not be combustible. The plastics bags can also be easily swallowed by animals and may block their digestive system and kill them

Figure 3.1:- Discarded plastic bags are a health hazard for grazing animals.

❖ **Hazardous wastes are defined as wastes that have one or more of the following properties:**

- **Corrosive** (substances that cause damage on contact e.g. acids)
- **Ignitable** (materials that can catch fire easily like benzene) .
- **Toxic** (materials that can be poisonous to humans when inhaled or ingested, or come in contact with skin or mucous membranes)
- **Reactive** (substances that can yield a harmful chemical if they react with other substances)
- **Infectious** (substances that are capable of causing or communicating infection).

✓ Potential sources of hazardous waste in rural households include obsolete pesticides, herbicides, or rodenticides. Non-hazardous wastes include all other types of waste

▪ **Functional Elements of Solid Waste Management**

- Functional elements of solid waste management are:-

1) Onsite handling,
2) Storage and processing
3) Collection
4) Transfer and transport

5) Resource recovery and processing
6) Disposal.

1) Onsite handling, storage and processing

- **Onsite handling** means the functional element that concerned with the managing of solid waste at the place where the waste is generated. For residential this means at home in the household Onsite handling is the first step in the solid waste management. It involves individual family members, households and communities who need to know how to handle waste properly at this level.
- **Handling means** the separation of wastes into their different types so that they can be dealt with in the most appropriate way, for example, separating putriscible waste for composting. The benefits of appropriate onsite handling include reducing the volume of waste for final disposal and recovering usable materials.
- **Onsite storage** means the temporary collection of waste at the household level. It is important that waste is stored in proper containers. These could be baskets, preferably made from locally available materials, plastic buckets or metal container
- The size of the container should be sufficient to hold at least the amount of solid waste that is generated per day at household level. Institutions and Businesses should consider having onsite storage facilities with greater Capacity.
- The proper location of storage containers and the frequency and time of emptying are important factors to be considered for efficient onsite storage.
- Some wastes will need some sort of onsite processing before the next steps, for example, in areas where false banana (enset) is used as a staple crop, the byproducts should be chopped into pieces before composting to speed up the rate of decomposition.

Figure 3.2:- Waste basket provided local guides association at Lake Tana monasary

2) Collection, transfer and transport of solid waste

- In most of the time, in urban centers, collection is a function element that has its own process and services.
- Waste is collected and held at central transfer stations where waste is stored before it is transported to a final disposal site. In rural areas, waste is not normally collected in this way and disposal is limited to onsite processing options although sometimes there may be communal collection of solid waste using animal carts.

3) **Disposal of solid waste**

- Even after recycling and resource recovery there will almost certainly be some residual waste that needs final disposal.
- Dumping Open field is the most unsanitary method of refuse disposal and is most likely to cause a health hazard.
- Sanitary methods including controlled tipping or controlled burial, incineration and sanitary landfill are discussed later in this study session.

- **Integrated solid waste management**
  - Practically, different solid waste management's were applied in the community set up without considering the basic concepts, principles, and scientific rule of safety consideration.
- **In scientific ways the solid waste can be managed in the following ways:-**

❖ **Integrated solid waste management**

- ✓ The concept of **integrated solid waste management (ISWM**) mostly applied to municipal solid waste management in urban centers. However, the principles can be applied to some extent in rural and pre-urban solid waste management.
- ✓ In most of the time, ISWM approach means considering not only the appropriate disposal of solid waste but integrating this with other management options such as minimizing waste production, recycling, composting and other waste recovery options.
- ✓ The different options can be ranked in order of their desirability as management options. This is often represented in a diagram known as **the waste management hierarchy**

Figure 3.3: waste management hierarchy options from most desirable at the top to least desirable at the bottom

1) **Reduction strategies**
   - **Reductions strategies** are the ways that a household or community may use to reduce or minimize the amount of solid waste they produce. This approach is generally more relevant in affluent homes and societies with a wasteful lifestyle.
   - **For example**, people with more money may not worry about throwing household items away when they can afford to buy replacements. In a business context, using two-sided photocopying of a document reduces the paper used and also therefore the waste produced.
2) **Reuse strategies**
   - **Reuse** refers to the act of using an item more than once, either for the same or similar purpose

- **For example,** used plastic bottles and other containers for sale to be reused. Unlike recycling and other recovery options, reuse does not require reprocessing and therefore requires less energy.


Figure 3.4: Plastic containers are frequently reused.

3) **Recovery strategies: recycling, composting and energy recycling**

- **Recycling** is a process by which waste is processed in some way to be reformed into new or similar products.
  - ✓ The principle is to make a usable product from the waste. Plastic bottles, newspapers, cardboard and tin cans can all be reprocessed and made into new items.
  - ✓ Plastic bags can also be recycled and used to make mats, carpets and other products. Waste metal has a number of possible uses because it is relatively easy to recycling.
  - ✓ Careful separation of the waste into its different types is important for the efficiency of recycling processes.
  - ✓ Recycling not only reduces the quantity of waste but saves money so there is an economic, as well as an environmental, incentive to recycle.

Figure 3.5: Waste metal can be recycled by using it to make new and different products.

❖ **Composting of organic solid wastes**

- **Non-hazardous** or putriscible solid wastes such as crop residues, leaves, grass and animal manures can be managed onsite by composting.
- Composting is a controlled process in which this type of waste is collected in an open pit or heap and is decomposed by natural biological processes. In this solid waste management, the waste is converted in to a stabilized material that can be used as fertilizes.
- **Composting** is an environmentally-friendly way of recovering value from organic waste. both human waste and organic household waste can be composted. However, the process is different.
- Human waste can be composted in alternating double pit latrines and in ecological sanitation systems. This process of composting is anaerobic. In the case of organic household waste composting, it is an aerobic process.
- **Aerobic** processes require oxygen or air to be present. **Anaerobic** processes take place without oxygen.
- The pit for composting should be dug about 50 m away from a dwelling. The pit needs to be about 1 meter deep and at least 1m breadth and 1m length. However, the size can vary with the amount of waste generated.
- The pit depth should be slightly less, about 90 cm, on one side to make a slope so that water does not collect at the bottom. To make the compost, organic matter such as grass, leaves and kitchen/food waste should be thrown into the pit in a shallow layer.
- It is very important that only biodegradable material is added so care is needed to sort the waste beforehand. No plastic should be included and bones should be avoided. The waste should then be covered with a thin layer of soil.

- Covering with soil encourages the composting process and prevents the breeding of flies and other vermin. Air must be allowed to mix with the compost so contents of the pit need to be turned frequently by digging.
- The compost needs a small amount of water to keep it moist. The time for the compost to be ready will vary depending on the temperature and the mix of waste among other factors but it should be ready within a few months. Composting is mostly practiced in rural communities.
- In Ethiopia, it is becoming customary for households to prepare compost from their household organic wastes and you should encourage this practice.

❖ **Energy from incineration**

- Incineration is another waste management method, which means that it is something is to burn. In waste management terms however, incineration means burning in a controlled and managed process usually at high temperature.
- Incineration cannot be implemented at household level; it is mostly used for institutional waste management purposes.
- Different types of incinerator are used for burning waste. They differ by the temperature at which they operate the cost of construction, the method of operation and the maintenance requirement.
- Incinerators can be used for disposal of wastes in health institutions/health posts and government and private institutions/offices/industries.
- Incineration can reduce the volume of refuse by up to 90% the only remaining residual waste is ash. This significantly reduces the volume of material needing final disposal.
- Incineration is only classed as recovery 'in waste management if the energy (heat) that is produced is used in some way.

Figure 3.6:- An incinerator used for healthcare waste.

▪ **Final disposal of solid waste**

❖ **Sanitary landfill**

- Controlled filling of compacted layers of solid waste and soil into pre-prepared land.

- Large-scale landfill sites for municipal waste need to be designed to protect surface and groundwater from contamination by leachate, the liquid waste that may seep out into the ground underneath the layers of waste.
- Sanitary landfill sites are not just rubbish dumps for open field dumping. To be classed as sanitary the site must be managed to minimize any negative environmental impact.

❖ **Controlled tipping or controlled burial**

- Similar in principle to sanitary landfill but at a smaller scale that is appropriate in rural areas. In controlled tipping/burial, solid waste is disposed of into a dug pit and is regularly covered with soil to avoid attracting disease vectors such as flies and rodents.
- Covering the waste also stops it from being blown by the wind and avoids bad smells, hence '**controlled'**.

❖ **A refuse pit**

- A simple pit used to dispose of household refuse, which may or may not be used for controlled tipping (with soil).
- Some wastes will need to be buried under soil as soon as they are disposed of in which case the pit may be referred to as a burial pit.
- When there is a need for preparing a refuse pit for households, you should advise them that sites for controlled tipping should be 10 m away from the house (preferably at the back of the house), at least 15 m and preferably 30– 50 m away from water wells and at a lower ground level. At community level, a communal refuse pit should be 100 m away from houses and they will also need to consider the direction of wind.
- The site should be easily accessible, with adequate space and should be fenced so that it is not accessible to children and domestic animals.
- Care must be taken to avoid creating places that could harbor rats or encourage the breeding of flies and other insects. Waste from individual households should be taken to the site in suitable containers such as sacks, plastic bags or buckets. For a community waste disposal pit, it should be a collective responsibility to keep communal areas clean.
- Animal carcasses need to be disposed of carefully because they can encourage the breeding of flies and rodents and attract scavenger animals. They can be disposed of in a common burial pit for the community.

Figure 3.7:- Refuse pit with a fence to prevent people or animals from accidentally falling in.

❖ **Burning of waste**

- Is another less desirable, method of final disposal?
- A burning site should be sited downwind and well away from houses.
- Non-combustible materials such as broken bottles, bones, etc. should be separated and buried at a safe location, not used by farming.
- Ashes that remain after burning can be used as fertilizer or, if mixed with mud, can be used for plastering of earth walls or floors.

Self check	Written test

Direction: - Choose the correct answer from the given alternatives

1. Separation of wastes into their different types

A) Collection **B)** Resource recovery **C)** Handling **D)** Storage

2. The least desirable waste management option

A) Reduction **B)** Disposal **C**) Reuse **D**) None

3. All are the characteristics of hazardous waste **except**

A) Corrosive **B)** Ignitable **C)** Toxic **D)** None

4. The decomposing bacteria found in pit latrines.

A) Anaerobic **B)** Aerobic **C)** Both **D)** None

5. The digested waste matter is

A) Sewage **B)** Sullage **C)** sludge **D)** All

6. The retention time of the wastewater in septic tanks should be a minimum of ----- hours

A) 48hrs **B)** 19hrs **C)** 29hrs **D)** 15hrs

Note: Satisfactory rating - 4 points unsatisfactory below-4 points

You can ask you teacher for the copy of the correct answers

Answer Sheet

Score _____

Rating _____

Name: _____ Date: _____

Short Answer Question

1._____ 4._____

2._____ 5._____

3. _____ 6._____

3.2 Healthcare Waste Management

3.2.1 Sources and Classification of Healthcare Waste

- Healthcare waste can be defined as any waste produced by healthcare activities. It may also be known as medical waste, hospital waste or infectious waste. The major sources include hospitals, health posts, emergency medical care services, healthcare centers and dispensaries, obstetric and maternity clinics, outpatient clinics and the like. Other sources are dental clinics, psychiatric hospitals, cosmetic ear-piercing and tattoo parlors, and illegal drug users.

- **Healthcare waste can be put into one of two broad categories:-**
  - **Non-hazardous (general waste):- is** between 75% and 90% of the waste produced in healthcare establishments are general waste. This includes papers, packaging materials, dust and the like. This can be disposed of in the same way as other non-hazardous wastes, but only if is not contaminated by contact with hazardous wastes.
  - The **remaining 10–25% of waste is hazardous:-** is composed of sharps (needles, lancets, etc.), syringes, blood or body fluid, contaminated surgical instruments, delivery bowls, used gauzes and gloves, plasters, etc.
    - ✓ It may also contain expired drugs, lab reagents and other chemicals. Your main concern here should be on managing the hazardous wastes in a safe way. However, you should not ignore non-hazardous wastes, because poor handling and segregation can lead to them being contaminated with hazardous materials.
    - ✓ **Noso comical infection,** also called hospital-acquired infections, is infections acquired during hospital care which is not present or incubating at admission. Infections occurring more than 48 hours after admission are usually considered nosocomial.
- **You can categories hazardous healthcare waste into:-**
  - **Infectious waste:** waste that may contain pathogens. This includes used dressings, swabs and other materials or equipment that have been in contact with infected patients or excreta. It also includes liquid waste such as faeces, urine, blood and other body secretions.
  - **Pathological waste:** human tissues including placentas, body parts, blood and fetuses. Anatomical waste is a sub-group of pathological waste and consists of recognizable body parts.
  - **Sharps:** needles, infusion sets, scalpels, blades and broken glass.
  - **Pharmaceutical waste**: expired or no longer needed pharmaceuticals; items contaminated by or containing pharmaceuticals (bottles, boxes).
  - **Genotoxic waste**: substances with genotoxic properties (meaning they can cause genetic damage) such as certain drugs and genotoxic chemicals.
  - **Chemical waste:** wastes containing chemical substances such as laboratory reagents, film developer, disinfectants that are expired or no longer needed, and solvents.
  - **Waste with high content of heavy metals**: includes batteries, broken thermometers, blood-pressure gauges, etc.
  - **Pressurized containers:** gas cylinders, gas cartridges and aerosol cans.
  - **Radioactive waste:** containing radioactive substances from radiotherapy or laboratory research.

3.2.2 Public health importance of healthcare waste

- If there is little or no segregation of non-hazardous and hazardous waste, it is inevitable that the general waste component will become contaminated and must then be regarded as hazardous.

- Everyone in the community is potentially at risk from exposure to healthcare waste, including people within the healthcare establishment and those who may be exposed to it as a result of poor management of the waste.
- Infectious wastes may contain a variety of pathogenic microorganisms. The route of entry into the body for microorganisms may be through a puncture, abrasion or cut in the skin, possibly caused by sharps contaminated with pathogens. Entry may also be through the mucous membranes (such as eye, mouth or nose), by inhalation or by ingestion
- There is a particular concern about infection with human immunodeficiency virus (HIV) and hepatitis viruses B (HBV) and C via healthcare waste. These viruses are generally transmitted through needle stick injuries contaminated by human blood. Needle stick injuries are piercing wounds usually caused by the point of a needle but also by other sharp objects.

3.2.3. Management of Hazardous Healthcare Wastes

- The aim of healthcare waste management is to contain infectious waste and reduce risks to public health. The steps to achieve this goal include:-

1 Waste handling

- There are a number of basic guidelines for waste handling. All healthcare waste should be segregated and placed into waste bins by the person generating the waste at the point where waste is generated.
- All specific healthcare waste segregation, packaging and labeling needs to be explained to the medical and supporting staff. Information should be displayed in charts on the walls of each room. Carts and recyclable containers used for transport of healthcare waste should be disinfected after each use.
- Sanitary staff and sweepers must wear proper protective clothing at all times when handling infectious waste including face masks, aprons, boots, and heavy duty gloves, as required.

2. Waste minimization

- Waste minimization is the first and most important step in any waste management plan. Minimizing the amount of waste produced will help the environment by reducing the amount of waste to be disposed of or burned in incinerators, and consequently reduces air pollution.
- For effective waste minimization, you should always bear in mind that the materials and supplies purchased should create no or minimal wastes. However, it is important to note that minimizing waste should never be carried out if it compromises patient care or creates any other risk of infection.

3. Segregation of healthcare waste

- Segregation is the process of separating different categories of waste. Healthcare waste is usually segregated into color-coded waste bags or bins. This should take place at the source (when the waste is created).
- You should follow the guidelines for segregation of waste so that the different types of waste are kept separate and each can be handled safely and economically. Healthcare

facilities should provide colored waste receptacles specifically for each category of waste.

- The color-coding system aims to ensure immediate, easy and unambiguous (clear) identification and segregation of the waste which you are handling or going to treat.

❖ Based on the type of hazards involved, a different colour code and type of container is assigned and should be used as follows:

- **Black:** all bins or bags containing non-hazardous healthcare waste.
- **Yellow**: any kind of container filled with any type of infectious healthcare waste, including yellow safety boxes for sharps.
- **Red**: any kind of container filled with heavy metal or effluent.
- **White**: any container or bin filled with drug vials, ampoules or glass bottles for glass recycling or reuse.

4. Recycling and reuse of healthcare waste

- Reuse of some healthcare waste such as glassware is possible but only after cleaning and disinfection. Items should be immersed in a 0.5% chlorine solution for 10 minutes and carefully washed with a brush and soap, rinsed and dried before use.
- During the disinfection process, you should always protect your hands with appropriate gloves. It is also recommended that you autoclave the glassware at 121oC for at least 30 minutes after washing to ensure complete sterilization/disinfection. Only unbroken glassware should be reused; if it is broken it will be sharp waste and must be disposed of. Materials such as non contaminated glass and plastic items can be recycled.
- Recycling may increase the segregation criteria and require more effort on your part because separate containers are needed for materials to be recycled.

5. Use of safety box

- A safety box is used only for sharps It is designed as a puncture- and leak-resistant container for their collection and disposal. The advantage is it confines all sharps in one place and helps prevent reuse. The correct use of safety boxes can prevent needle stick injuries to you and the community. The role of health workers and waste handlers in proper use of safety boxes, starting from assembly through to final disposal.

Figure 4.1:- Safety box in use at a Health Post.

6. Packing healthcare wastes before disposal

- Some healthcare wastes need to be placed into special containers or packed up in a particular way before they are transported or disposed of.
- A safety box for sharps is one example. Liquid infectious wastes need to be placed in capped or tightly stopper bottles or flasks; large quantities would need a containment tank. Solid or semi-solid wastes should be packed in durable, tear-resistant plastic bags.
- Special packaging is required for items to be incinerated. These need to be put in combustible containers. Similarly items to be sterilized by steam need containers that

allow the passage of steam and air. Clean clothes can be used to wrap items that need to be autoclaved or sterilized.

7. Waste storage

- The guidelines for healthcare waste storage that you should follow are:
  - A specified place in each room where waste is generated for placing bags, bins or containers.
  - Separate central storage facilities for yellow bags should be provided with clear indication that no other materials be stored there.
  - No waste shall be stored for more than two days before being treated or disposed of. (This does not include safety boxes, where filled boxes can be kept locked up for up to one week if no onsite incinerator is available.)
  - On the storage area door and on waste containers, the universal biological hazard symbol should be posted.

Figure 4.2:- Biological hazard symbol.

3.2.4 Prevention and Control Risks to Healthcare Workers

1. Isolation of infected patients

- The first essential measure in preventing the spread of infections is isolation of infected patients. The term isolation covers a broad domain of measures.
- The strictest form of isolation is applied in case of very infectious diseases (e.g. tuberculosis, other respiratory infections, and infectious diarrhoea). Isolation implementation should therefore be adapted to the severity of the disease and to the causative agent.
- Disease-specific precautions should include details of all the measures (private sleeping room, separation of eating utensils and water drinking materials, etc.) to be taken in the case of a specific disease caused by a defined organism.

2 .Universal precautions

- Standard precautions is applied essentially protect healthcare workers from blood borne infections caused by human Immune deficiency virus (HIV) and hepatitis B and C viruses. it should be used in the care of all patients:

❖ **Hand washing**

- ✓ Wash hands after touching blood, secretions, excretions and contaminated items, whether or not gloves are worn. Wash hands immediately after gloves are removed, between patient contacts.
- ✓ Use a plain soap for routine hand washing.
- ✓ Use an antimicrobial agent for specific circumstances.

❖ **Gloves**

- ✓ Wear gloves when touching blood, body fluids, secretions, excretions, and contaminated items. Put on clean gloves just before touching mucous membranes and non-intact skin.

❖ **Mask, eye protection, face shield**

- ✓ Wear a mask and eye protection or a face shield during procedures and patient care activities that are likely to generate splashes or sprays of blood, body fluids, secretions, and excretions.

❖ **Gown**

- ✓ Wear a gown during procedures and patient-care activities that are likely to generate splashes or sprays of blood, body fluids, secretions, or excretions.

❖ **Patient-care equipment**

- ✓ Ensure that reusable equipment is not used for the care of another patient until it has been cleaned and reprocessed appropriately.

❖ **Environmental control**

- ✓ Ensure that the hospital has adequate procedures for the routine care, cleaning, and disinfection of environmental surfaces.

❖ **Linen**

- ✓ Handle used linen, soiled with blood, body fluids, secretions, and excretions in a manner that prevents skin and mucous membrane exposures, and that avoids transfer of microorganisms to other patients and environments.

❖ **Occupational health and blood borne pathogens**

- ✓ Take care to prevent injuries when using needles, scalpels, and other sharp instruments or devices.
- ✓ Use ventilation devices as an alternative to mouth-to-mouth resuscitation methods.

❖ **Place of care of the patient**

- ✓ Place a patient who contaminates the environment or who does not assist in maintaining appropriate hygiene in an isolated (or separate) room.

3. Cleaning

- ✓ One of the most basic measures for the maintenance of hygiene, and one that is particularly important in the hospital environment, is cleaning. The principal aim of cleaning is to remove visible dirt. It is essentially a mechanical process: the dirt is dissolved by water, diluted until it is no longer visible, and rinsed off. Soaps and detergents act as solubility promoting agents.
- ✓ The microbiological effect of cleaning is also essentially mechanical: bacteria and other microorganisms are suspended in the cleaning fluid and removed from the surface.
- ✓ The efficacy of the cleaning process depends completely on this mechanical action, since neither soap nor detergents possess any antimicrobial activity. Thorough cleaning will remove more than 90% of microorganisms. However, careless and superficial cleaning is much less effective; it is even possible that it has a negative effect, by dispersing the microorganisms over a greater surface and increasing the chance that they may contaminate other objects.
- ✓ Cleaning has therefore to be carried out in a standardized manner or, better, by automated means that will guarantee an adequate level of cleanliness.
- ✓ Diluting and removing the dirt also removes the breeding-ground or culture medium for bacteria and fungi. Most non-spore former bacteria and viruses survive only when they are protected by dirt or a film of organic matter; otherwise they dry out and die. Non-

speculating bacteria are unlikely to survive on clean surfaces. The effectiveness of disinfection and sterilization is increased by prior or simultaneous cleaning.

4. Sterilization

- ✓ Object should be sterile, i.e. free of microorganisms, after sterilization. However, sterilization is never absolute; by definition, it effects a reduction in the number of microorganisms by a factor of more than 106 (i.e. more than 99.9999% are killed).
- ✓ Physical methods are based on the action of heat (autoclaving, dry thermal or wet thermal sterilization), on irradiation, or on mechanical separation by filtration.
- ✓ Chemical method means include gas sterilization with ethylene oxide or other gases, and immersion in a disinfectant solution with sterilizing properties (e.g. glutaraldehyde) and based on the situation you can use locally available sterilization methods like boiling.

Figure 5.1:- Autoclave in a Health Post.

5. **Disinfection**

- There are three level of disinfection.
  1. **High-level disinfection**: can be expected to destroy all microorganisms, with the exception of large numbers of bacterial spores.
  2. **Intermediate disinfection**: inactivates Mycobacterium tuberculosis, vegetative bacteria, most viruses, and most fungi; does not necessarily kill bacterial spores.
  3. **Low-level disinfection**: can kill most bacteria, some viruses, and some fungi; cannot be relied on to kill resistant microorganisms such as tubercle bacilli or bacterial spores.

  - ➢ A disinfectant solution is considered appropriate when the compromise between the antimicrobial activity and the toxicity of the product is satisfactory for the given application. Another consideration may well be the cost.
  - ➢ The more active disinfectants are automatically the more toxic ones; potentially toxic products can be applied to inanimate objects or surfaces, whereas for disinfection of human tissues only the less toxic disinfectants can be considered. For antisepsis, different disinfectants are used for application to the intact skin (e.g. alcoholic solutions) and to mucous membranes or wounds (only aqueous solutions of non-toxic substances).
  - ➢ Cost is a less important consideration for an antiseptic than for a disinfectant.
  - ➢ The principal requirements for a good antiseptic are absence of toxicity and rapid and adequate activity on both the natural flora and, especially, pathogenic bacteria and other microorganisms after a very short exposure time.

- Essential requirements for a disinfectant are somewhat different: there must be adequate activity against bacteria, fungi, and viruses that may be present in large numbers and protected by dirt or organic matter. In addition, since disinfectants are applied in large quantities, they should be of low contamination.
- In general, use of the chosen disinfectant, at the appropriate concentration and for the appropriate time, should kill pathogenic microorganisms, rendering an object safe for use in a patient, or human tissue free of pathogens to exclude cross-contamination.

6. Hand hygiene

- As the hands of healthcare workers are the most frequent vehicle of nosocomial infections, hand hygiene including both hand washing and hand disinfection is the primary preventive measure. Thorough hand washing with adequate quantities of water and soap removes more than 90% of the transient, i.e. superficial, flora including all or most contaminants. An antimicrobial soap will further reduce the transient flora, but only if used for several minutes.
- Hand washing with (non-medicated) soap is essential when hands are dirty and should be routine after physical contact with a patient. Killing all transient floras with all contaminants within a short time (a few seconds) necessitates hygienic hand disinfection: only alcohol or alcoholic preparations act sufficiently fast. Hands should be disinfected with alcohol when an infected tissue or body fluid is touched without gloves.
- During a surgical intervention, a high proportion of gloves become perforated. Hands should therefore be disinfected with a long-acting disinfectant before gloves are put on. This will not only kill all transient floras, but will also prevent the microorganisms of the resident flora from taking the place of the transient flora during the intervention.

3.2.5 Methods of Healthcare Waste Treatment and Disposal

1 .Incinerator

- Incineration is a high-temperature dry oxidation process that reduces organic and combustible waste to inorganic, incombustible matter and results in a very significant reduction of waste volume and weight.
- If the incinerator is properly designed, maintained and operated, it serves the purpose of destroying infectious microorganisms in the waste.
- It is controlled and managed burning, usually at high temperature.
- A waste incinerator needs to reach very high temperatures in order to completely destroy needles and syringes. This type of high temperature incinerator is unlikely to be available to you but other options for burning can be used at Health Post level.
  - If a brick-built incinerator is not available, you may be able to burn the waste in a converted metal drum or barrel.

- **To do metal drum or barrel:-**
  - You will need a metal drum with both ends removed to make a cylindrical container.
  - You will also need four bricks and two rigid metal screens that are large enough to cover the open ends of the drum.
  - You will need to place the drum in a fenced area away from the Health Post buildings.
  - Place the bricks on the ground, with spaces between them and a metal screen or grate on top.
  - Place the open base of the drum on the metal screen and put another screen on top.
  - The metal screens are to allow air to flow around the burning waste so the fire gets hotter, and to reduce the amount of ashes flying out of the top.
  - Put the safety box or other waste with some paper, dry leaves, or small sticks into the drum, sprinkle them with a small amount of kerosene .
  - Put paper under the drum, between the bricks, and set light to it so the flames rise through the metal screen.

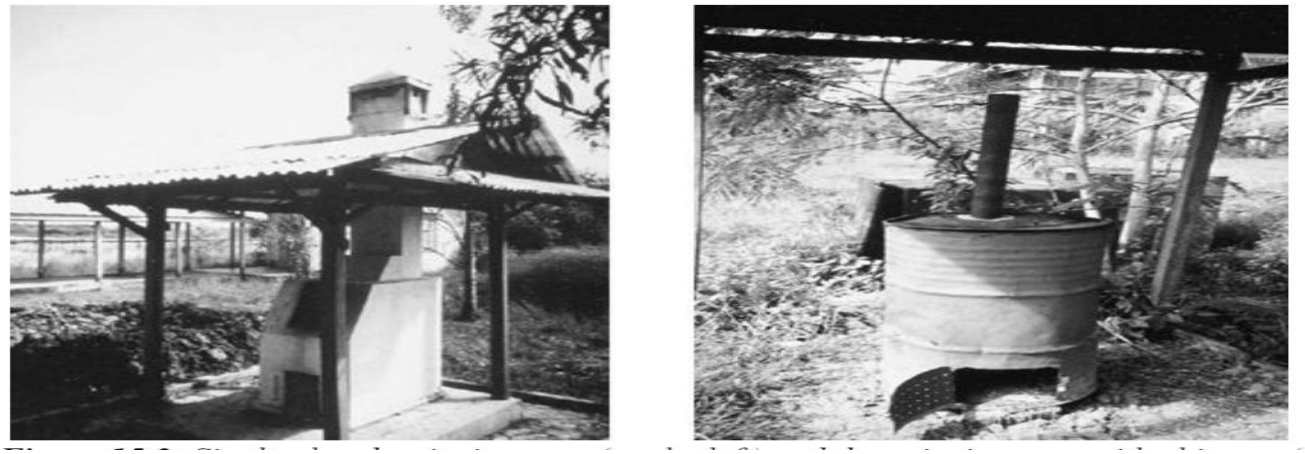

Figure 5.2: Single-chamber incinerator (on the left) and drum incinerator with chimney (on the right)

2. Open pit burning

- If there are no incinerators, then open pit burning is also possible, and frequently used in rural Health Posts.
- The pit must be protected with a fence to prevent people or animals from gaining access to it. It is advisable to watch the fire until everything is burned to be sure that no waste is

blown around by the wind or left unburned. The ash or residue must be buried for final disposal.

Figure 5.3:- Open pit burning of healthcare waste.

3. Encapsulation

- Disposal of healthcare waste in municipal landfills is less advisable if it is untreated than if it is pretreated.
- One option for pretreatment is encapsulation, which involves filling containers with waste, adding an immobilizing material, and sealing the containers.
- The process uses either cubic boxes made of high-density polyethylene or metallic drums, which are three-quarters filled with sharps and chemical or pharmaceutical residues.
- The containers or boxes are then filled up with a medium such as plastic foam, bituminous sand, cement mortar, or clay material.
- After the medium has dried, the containers are sealed and disposed of in landfill sites. This process is relatively cheap, safe, and particularly appropriate for establishments that practice **minimal programs** for the disposal of sharps and chemical or pharmaceutical residues.
- Encapsulation alone is not recommended for non-sharp infectious waste, but may be used in combination with burning of such waste.
- The main advantage of the process is that it is very effective in reducing the risk of scavengers gaining access to the hazardous healthcare waste.

4. Sharps pit

- A sharps pit is a particular type of burial pit that should be used only for the final disposal of needles and other sharps. Safety boxes should be incinerated to sterilize the contents before carefully collecting the residue for disposal in the sharps pit.
- A properly constructed sharps pit should have a cover at the surface and be lined with cement to make it watertight in order to avoid contamination of groundwater and soil.

- It must have a fence around it. For a Health Post, the pit need not be large and can take many years to fill.

5. Safe burial on health post premises

- Burial pits are acceptable for some wastes but ideally, there should be separate pits for general healthcare wastes and for hazardous healthcare waste.
- The general waste could be transported to community refuse pits, if there are any. Burial pits for hazardous waste should be properly fenced to prevent access by people or animals.
- The bottom of the pit should be at least 1.5 metres higher than the groundwater table for disposal of solid waste. You should make sure that the final disposal of hazardous waste by reputable waste handlers is performed according to applicable federal and local regulations

- **Certain basic rules/criteria should be followed:-**
  - Access to the disposal site should be restricted to authorized personnel only.
  - The burial site should be lined with a material of low permeability, such as clay, if available, to prevent pollution of any shallow groundwater that may subsequently reach nearby wells.
  - Only hazardous healthcare waste should be buried. If general hospital waste were also buried on the premises, available space would be quickly filled up.
  - Large quantities (>1kg) of chemical wastes should not be buried at one time. Burying smaller quantities avoids serious problems of environmental pollution.
  - The burial site should be managed as a landfill, with each layer of waste being covered with a layer of earth to prevent odors, as well as to prevent rodents and insects proliferating.

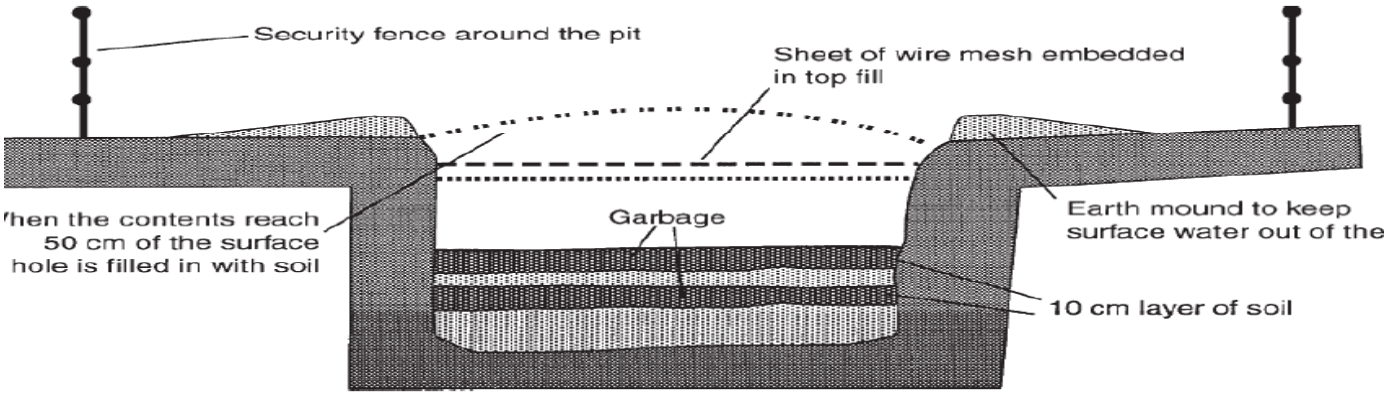

Figure 5.4: Example of a small burial pit for healthcare waste

Self check #2	Written test

Direction: - say “True” or “False”

1. Healthcare waste contains hazardous and non-hazardous waste.
2. Infectious healthcare waste is kept in red containers.
3. Chemical disinfection involves treating waste with 0.5% chlorine solution for 10 minutes by immersing in an autoclave.

Note: Satisfactory rating 3 points unsatisfactory below 3 points

You can ask you teacher for the copy of the correct answers

Answer Sheet

Score _____

Rating _____

Name: _____ Date: _____

Short Answer Question

1._____

2._____

3. _____

3.3 Latrine Construction

3.3.1 Concepts and Principles of Latrine Construction

- Safe human excreta disposal is crucial for preventing the spread of infectious diseases. Communities and planners need to realize that safe human excreta disposal brings about huge health benefits. The control and management of wastes are an essential.
- In rural areas, the users themselves are largely involved in preventive maintenance activities for wastewater and solid waste disposal. Awareness campaigns, and involving the community in sanitation problems, can both help to change behavior in communities, and improve basic sanitation systems.

❖ **Factors to consider when choosing a sanitation system for excreta disposal include:**

- The initial cost of the technology.
- Demand and use (what is the population density, and will the system be used in homes, schools, market places.
- Climate (temperature, humidity and rainfall).
- Soil and topography (infiltration properties of the soil, and what is the direction of the groundwater flow).
- Water availability (for waterborne systems).
- Cultural beliefs, values and practices on sanitation.
- The availability of technical skills (are there local craftsmen or technicians with the necessary skills to install and/or carry out the system).
- Agriculture (what are the characteristics of the local agriculture and home gardening).

3.3.2 Types of latrine

- Pit latrines are simple drop and store systems in which the liquid waste collects in a pit below.

▪ **There are many different designs of pit latrine:-**

1. In places where water is more easily available, typical methods are drop-flushand-discharge systems, also known as water carriage systems, such as the pour-flush latrine or a water closet (W.C.)
2. The most usual method of onsite liquid waste containment in rural Ethiopia is the pit latrine. Pit latrines are simple drop and- store systems in which the liquid waste collects in a pit below.

- **There are many different designs of pit latrine:-**
  - ✓ Simple pit latrine
  - ✓ VIP latrine
  - ✓ Ecology sanitation

▪ **Classification based on improvement:-**

❖ **Improved sanitation services or methods include:**

- W.C. or flush toilet to piped sewer system or septic tank.
- Pour-flush latrine.
- Pit latrine with slab.
- Ventilated Improved Pit (VIP) latrine.
- Ecological sanitation (a type of latrine that converts human waste into useful material without damaging the environment or endangering human health).

❖ **Unimproved sanitation methods include:**

- Service or bucket latrines (where excreta are manually removed).
- Pit latrine without slab.
- Open latrines.
- Excretion in the environment (or simply, open field defecation).
- Bucket latrine

3.3.3 Role of the Health Extension Worker in Latrine Construction

- Promote latrine construction by giving advice and encouragement to people in your community to install or improve sanitation systems.
- The process of latrine construction, you can help develop skills in your local area. With the help of district health offices, you should be encouraging local artisans and entrepreneurs to create a sanitary service chain of, for example, prefabricated slabs. You can also promote training of local people on proper latrine construction techniques, especially for improved types of latrine.
- You can also assist with training of model family household members in your community. Although they may not be common in rural Ethiopia, you should also be familiar with the concepts in higher level sanitation facilities such as water carried systems because you may be involved in advising households who want to upgrade their facilities up the sanitation ladder, step by step. Whichever type of latrine is used, your role is to promote good sanitation and hygiene wherever possible

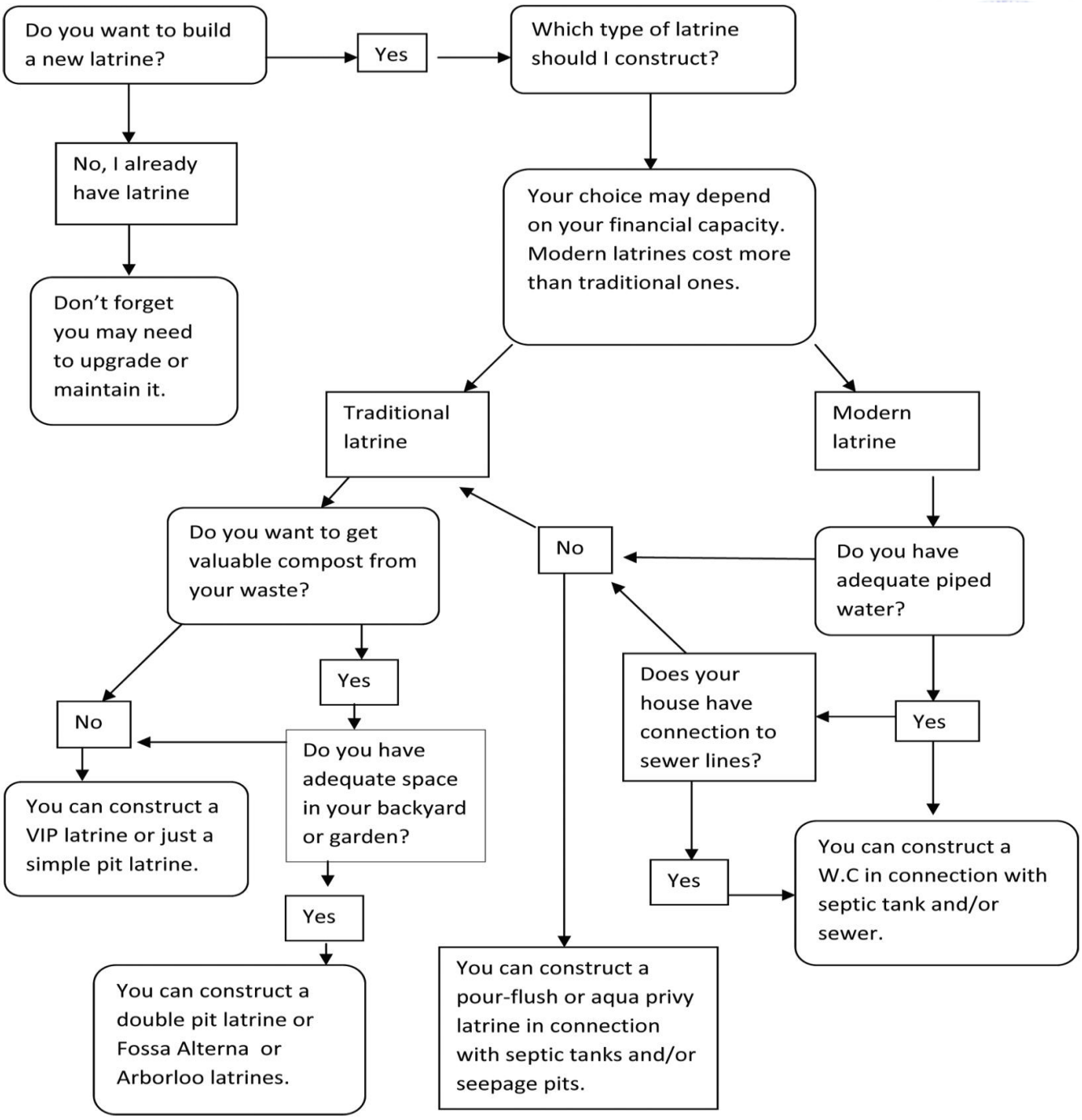

Figure3.3: Decision tree for latrine options

Self check #3	Written test

Direction: - Choose the correct answer from the given alternatives

1. Improved sanitation services

A. Bucket latrine B. Pour-flush latrine. C. Open latrines. D. All

2. Pit latrine simple drop and- store systems in which the liquid waste collects in a pit below.

A. Pour-flush latrine B. water closet C. Ecology sanitation D. All

Note: Satisfactory rating 3 points unsatisfactory below 3 points

You can ask you teacher for the copy of the correct answers

Answer Sheet

Score _____

Rating _____

Name: _____ Date: _____

Short Answer Question

1._____

2._____

3.4 Latrine Utilization Changing Attitudes and Behavior

3.4.1 Factors affecting the Use of Latrines and Hand Washing Facilities

- The possession of an improved latrine, on its own, will not halt of faeco-orally transmitted diseases among the people of your community. For this to have an impact on health, the people have to use their latrines and hand washing facilities effectively.

❖ F**actors that affects the use of latrine** in the community.

- Behavioral, demographic, geographic, climatic, social, cultural and economic, the bad smell of a latrine, lack of privacy if the shelter is inadequate, childhood habits that are hard to break and many more reasons can deter families from using latrines.
- For example, elderly or uneducated people in rural areas may find it difficult to get used to new, technologies and may resist the adoption of new behaviors‘.
- In some local, cultures, people may not want to share latrines with others; for example, women may not want to share the same facility as their father-in-law and there are some cultural practices that inhibit the use of one latrine by both the husband and wife.
- Children‘s faeces are often mistakenly considered not to be a potential health hazard and it may be considered unimportant for children to use the latrine. Household members may be discouraged from using the latrine at night because of the fear that evil‘or devils‘inhabit the latrine during that time. Another factor is the misconception that prevails among some farmers that using the cat-system‘(i.e. burying excreta or leaving it open in a field) will improve the soil condition.
- There is also an anther factors which affects the use of latrines are inappropriate materials for latrine construction, the collapse of latrines, rain during rainy season etc, so that you need to identify the factors affecting the use of latrines relevant way with in your community is mandatory in order to improve the utilization of latrine within the community and farther more for health promotion by conducting an open discussion with that community.

❖ F**actors affecting Hand washing practices**

- Some family members in rural households may not **practice proper hand washing** due to poor attitude to hand washing and affordability to buy soap and utensils/equipments.
- Therefore you should focus on individual and communal communication to change the attitude of people towards the direct (health) and the indirect (economic) benefits of hand washing.
- You can recommend the use of locally available materials such as ash for detergent purposes, and tin cans or jerrycansǁ as hand washing devices and check that the hand washing facility is conveniently placed near latrines and that the water is clean to avoid further contamination.

3.4.2 Benefits of Hygiene and Sanitation Behavior Change

- Proper hygiene, adequate sanitation and safe drinking water have significant benefits for human health. You have also learned about the need to practice positive behaviors. Any change from bad habits to good practice is described as behavior change.

❖ **Critical times for hand washing are after visiting the latrine** :-

- ✓ After visiting latrine

- ✓ After cleaning a child's bottom
- ✓ Before preparing food and before eating meals or feeding children.

- Promotion of hygiene and proper sanitation is the single most important way to improve the health of your community.
- The right approaches need to be used to change behavior and get people to take better care of themselves, their family's health, and their environment. As health is an asset to a community, its improvement enhances economic development and brings wealth to a society.

Figure 4.1:- Adults and children should always wash their hands after using the latrine.

3.4.3 Motivating people to change their behavior

- Health education is frequently delivered by someone lecturing about hygiene and sanitation in health facilities and community gatherings. However, such an approach is not recommended as the sole means to achieve individual behavior change. Because human behavior is influenced by the surrounding environment and social context, **specific messages** instead of **universal messages** of hygiene and sanitation are more important.
- Hygiene messages must culturally suitable, and comfortable, for your community .If you are trying to **change behavior** by targeting individuals you need to consider not only their prior experience but also their learned behaviors. These are the habits gained by **social learning channels or socialization** i.e. from parents, friends and opinion leaders in their community.
- Each individual has their own beliefs, values and knowledge about health practices. People may ask themselves, before adopting a new behavior, if the new practices are going to fit with their ideas and way of life. They need to be convinced that there will be important benefits from changing their behavior and you can use different motivational techniques' to get good effect
- **Your role** would be to ensure that they have the necessary knowledge and skill ,and develop the right attitude to help other households in learning about hygiene and sanitation.

- It is also important that model households are recognized and rewarded by the community leaders, both traditional and formal, and acknowledged by community members, friends and neighbors' in order to sustain the existing achievements and encourage others to progress well. In order to have an impact on health, any change in health practice needs to be adopted by many individuals in your community**.**
- **Shared behavior** is only achieved when the community themselves feel there is a problem, and are motivated to solve the problem by jointly taking actions that would permanently improve health conditions.

3.4.4 Monitoring and Evaluation of Latrine Utilization

- Any programme that is promoting behavior change needs to have a process for assessing how effective it is, in other words, a monitoring and evaluation process.
- Latrine utilization promotion and other WASH projects therefore need to include monitoring and evaluation activities. This means setting specific measurable and achievable objectives and clearly stating the monitoring activities and indicators to be used.
- There is an important preliminary step which is to gather baseline data of the situation before the intervention for comparison with the data gathered by the monitoring activities. The same indicators should be used both before and after so you can compare like with like.

- **Important measurable indicators for latrine use and hand washing include:**
  - no visible human excreta in likely sites
  - percentage of households that have a latrine and which is seen to be in use
  - percentage of latrines with no faeces and urine soiling on walls and floors
  - presence of hand washing facility and water near the latrine
  - presence of soap, ash or other cleaning agent near latrine
  - percentage of communities/villages certified as ODF
  - percentage of households that have upgraded their latrine to an improved system
  - percentage of households with clean compounds without any excreta

Self check #4	**Written test**

Direction: - Choose the correct answer from the given alternatives

1. Critical times for hand washing

A. After visiting latrine B. After cleaning a child's bottom C. Before preparing food D .All

Note: satisfactory rating 1 point unsatisfactory below 1 point

You can ask you teacher for the copy of the correct answers

Answer Sheet

Score _____

Rating _____

Name: _____ Date: _____

Information sheet # 5	Educating Public Health Importance of Vectors

3.5 Public Health Importance of Vectors

3.5.1 Definition of Vector

- **Vector: -** are arthropods and other invertebrates which transmit infection by inoculation into or through the skin or mucous membrane by biting or by deposit of infective materials on the skin or on food or other objects.
- Vectors can also be defined as any non-human carriers of pathogenic organisms that can transmit these organisms directly to humans.
- Vertebrates, such as dogs and rodents, and invertebrates, such as insects, can all be vectors of disease.
- **Rodent** comprise a great number of mammals, ranging in size from the rats and mice to as large as the Porcupines and which belong to vertebrates that transmits infection from an infected person or animal to a susceptible host.

3.5.2 Vector-born Disease Transmission Mechanism

- **Generally there are two types of vector borne disease transmission mechanism.**

1. Mechanical disease transmission:

- Is a type of disease transmission in which the vector is no more than a carrier that transmits pathogens without any change either on the number or form of disease pathogens
- **Example** Flies like to rest, feed and breed on faecal matter and then may move on to fresh food. They can carry infectious agents through their mouth and on their legs and other body parts.
- They deposit these agents on ready-to-eat foods and the recipient gets infected if they consume the contaminated food. Example-Trachoma, diarrhea

2. Biological disease transmission:

- Involves the multiplication and growth of a disease causing agent inside the vector‘s body.
- **Malaria is a good example** of biological transmission.
- The female mosquitoes take the malaria infectious agent (Plasmodium) from an infected person with a blood meal.
- After sexual reproduction in the gut of the mosquito, the infectious agent migrates into the salivary gland of the insect, where it grows in size, matures, and becomes ready to infect humans within the mosquito. When the mosquito next bites a any human for meal the saliva is injected into the skin and transfers the infection in doing so.

- **Common Vector of Borne- Diseases and their Control Methods**

1 Housefly

- The common housefly lives in close association with people all over the world. The insects feed on human foodstuffs and wastes where they can pick up and transport various disease causing agents. There are four distinct stages in the life of a fly: egg, larva or maggot, pupa and adult.
- The female fly lays 200–250 eggs at a time on organic matter such as human faeces, decaying animal and vegetable matter, fresh food or dung.

- Depending on the temperature, it takes from 6 to 42 days for the egg to develop into the adult fly. The length of life is usually 2–3 weeks but in cooler conditions it may be as long as three months.
- Flies can spread diseases because they feed freely on human food and waste matter.
- The fly picks up disease-causing organisms while crawling and feeding. Those that stick to the outside surfaces of the fly may survive for only a few hours, but those that are ingested with the food may survive in the fly's crop or gut for several days.
- Transmission takes place when the fly makes contact with people or their food.

❖ **Flies can transmit diseases**

✓ like enteric infections (such as dysentery, diarrhea, typhoid, cholera and certain helminth infections), eye infections (such as trachoma and epidemic conjunctivitis) , poliomyelitis and certain skin infections (such as cutaneous diphtheria)

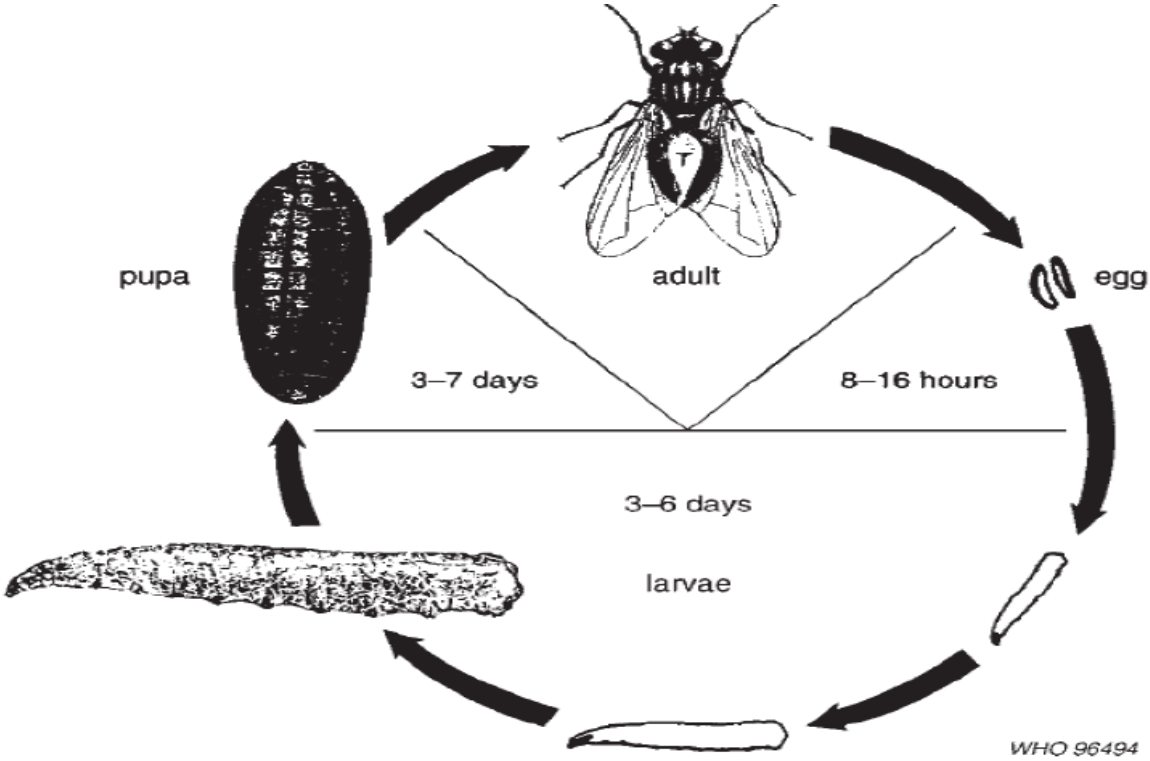

Figure 5.1: Life cycle of house fly.

2 Mosquitoes

- There are three main mosquito groups:
  - Anopheles mosquitoes breed in stagnant, relatively clean water bodies; 150–200 Eggs are laid in a group on the water surface
  - Culex breed in polluted water; 200–500 Eggs are laid in a group on the water surface
  - Aedes like relatively clean water lay egg singly
  - The laid egg hatch into larvae within a few hours. The larvae breathe oxygen from the air and stay at the surface of the water. They feed on organic matter and microorganisms in the water or on the surface.
  - The larva changes into a pupa which can propel itself using paddles at the bottom of the abdomen. The adult mosquito emerges from the pupa on to the surface of the water and then flies away. The duration of the cycle is about 10–14 days depending on the water temperature.

- Only female mosquitoes bite and suck blood; the males feed on the nectar of flowering plant. Females are attracted to a host by heat and exhaled carbon dioxide. A blood meal is required before viable eggs can be laid.
- During feeding on humans, a small amount of anticoagulant saliva will be injected into the host to prevent the blood from clotting. The malaria infectious agent is introduced into the bite site while feeding on blood.

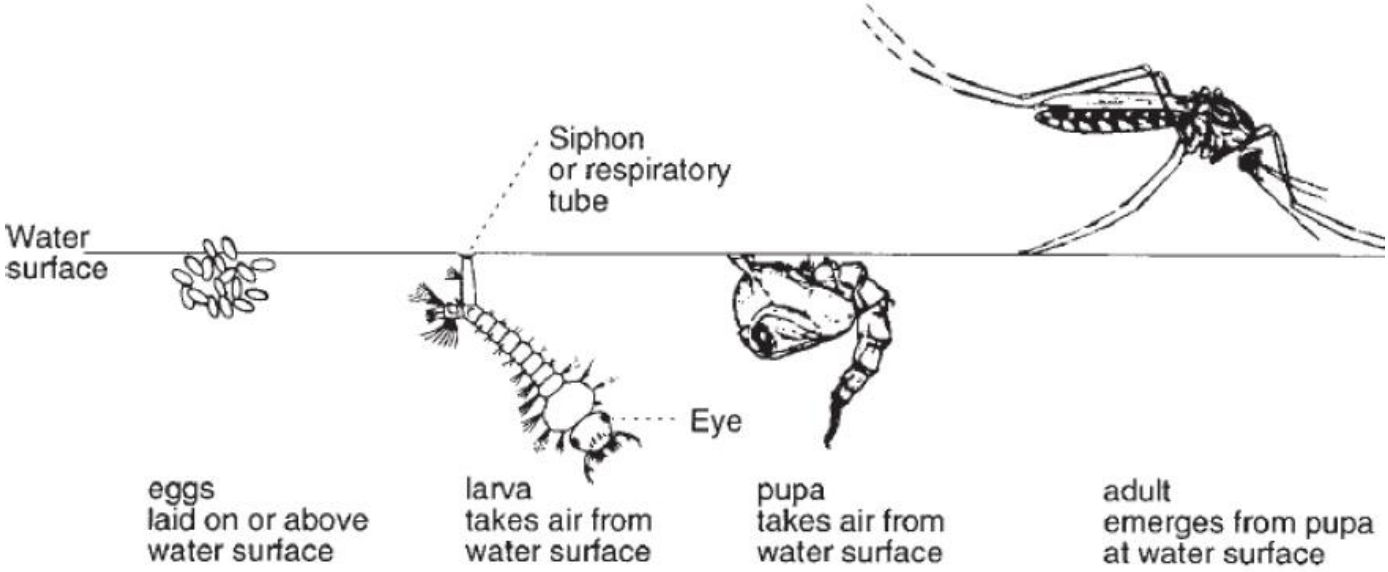

Figure 5.2: Life cycle of the mosquito

- **These species also rests at different resting position.**
  - Anopheles adults rest at an angle of about 45 degrees to the surface they are standing on, while adult Aedes and Culex rest with the body parallel to the surface.
  - The opposite is true for the larval resting position in relation to the water level. Anopheles larvae lie horizontally at the water surface but Culex and Aedes hang at an angle below the surface

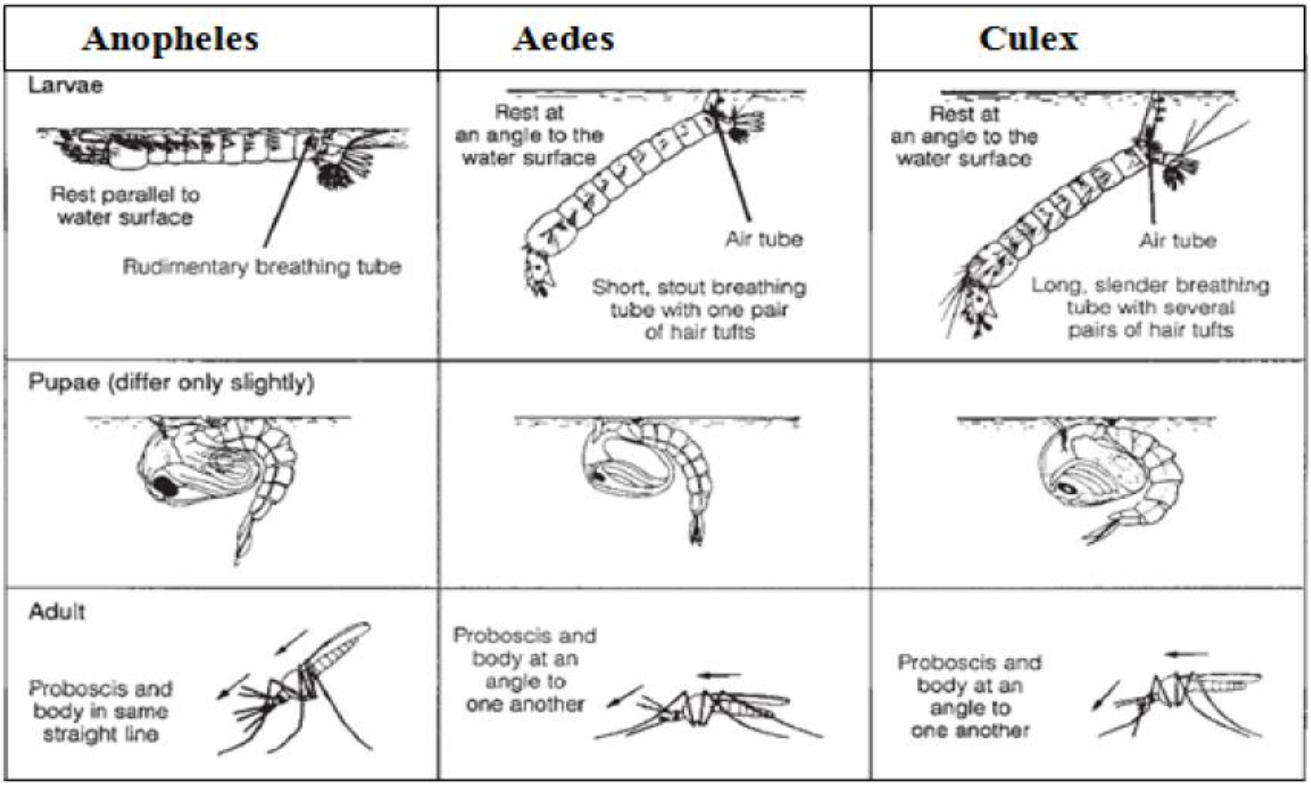

Figure 5.3: Comparison between different types of mosquito: Anopheles, Aedes and Culex

- **Different species of mosquito carry different diseases.**
  - Anophles :- transmit Malaria and filariasis
  - Culex :-transmit filariasis
  - Aedes:-transmit yellow fever and dengue fever

3. Lice

- There are three types of human louse: **the head louse, body louse and pubic louse**. All of them are wingless biting insects and live by sucking human blood. Being bitten by lice is painful, disturbing, embarrassing, and may cause an allergic reaction.
- **Head lice** eggs are laid at the base of the hair and then hatch, leaving the pale-colored egg casing, known as a nit‘on the hair. The larvae feed on blood until they reach sexual maturity. The life cycle takes about 15days with lying of about 300–350 eggs at a time.
- Body lice live in the clothing of the host, especially hiding in the seams. They move towards to the skin of the host to feed. Pubic lice favor the coarser body hair found in the pubic area and armpits.

- **Lice can transmit diseases** like Typhus fever, relapsing fever, dermatitis.

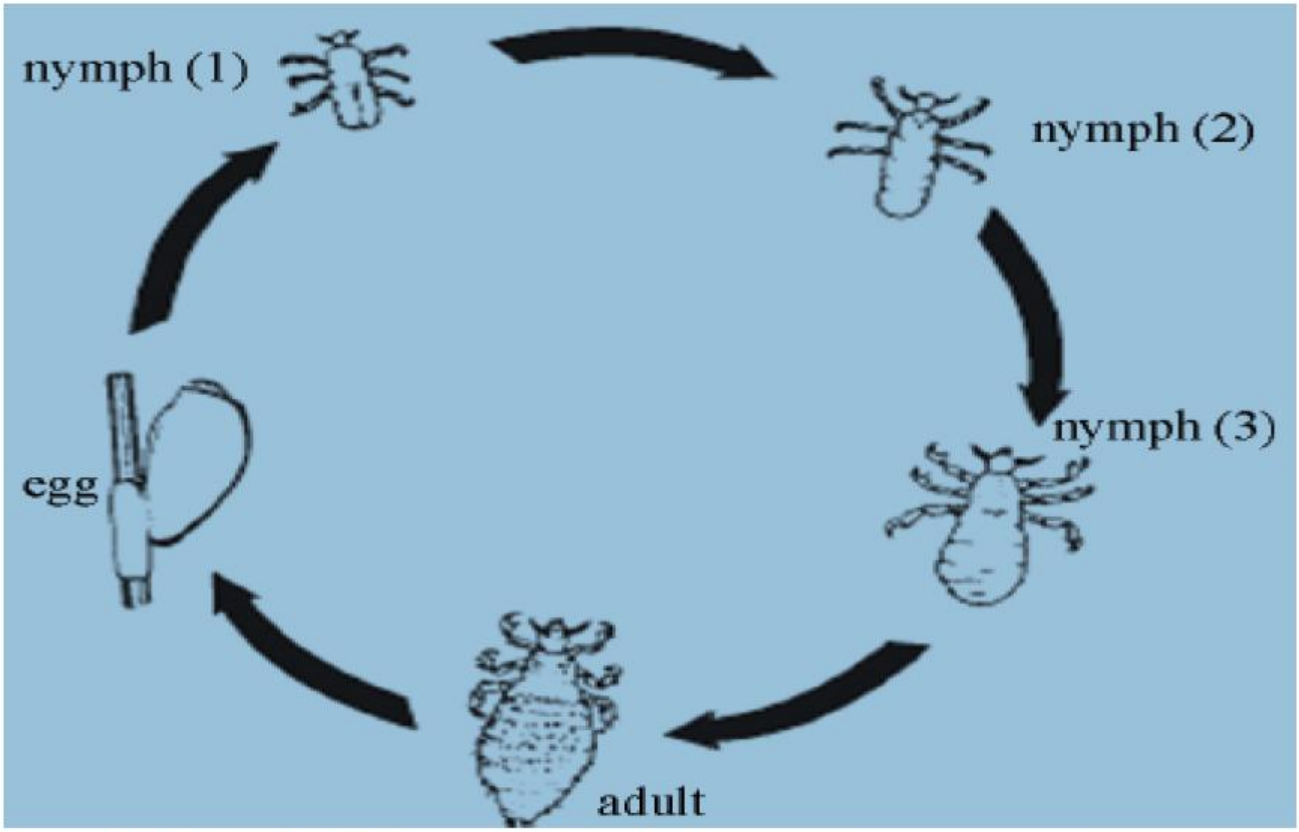

Figure 5.4: Life cycle of the louse.

4 Bedbugs

- Bedbugs are nocturnal or night-biting insects. They are typically found in houses with poor housing sanitation or in sub standard houses and are abundant in poor urban and rural areas. They irritate the person while sleeping and disturb the sleep of children.
- Bedbugs love to hide around the bed and inside crevices of the wall during the daytime, and then become active at night.
- Female bedbugs deposit three to eight eggs at a time. A total of 300–500 eggs can be produced by a single bug in a lifetime.
- They are often deposited in clusters and in cracks, crevices or attached to rough surfaces with a sticky glue-like substance. Eggs typically hatch in a week to 12 days .There are five larval stages for bedbugs to reach maturity, which usually takes about 32–48 days. Adult bedbugs can survive for up to seven months without blood and have been known to live in empty buildings for up to one year.

- **Bedbugs can transmit** dermatitis and chagas disease.

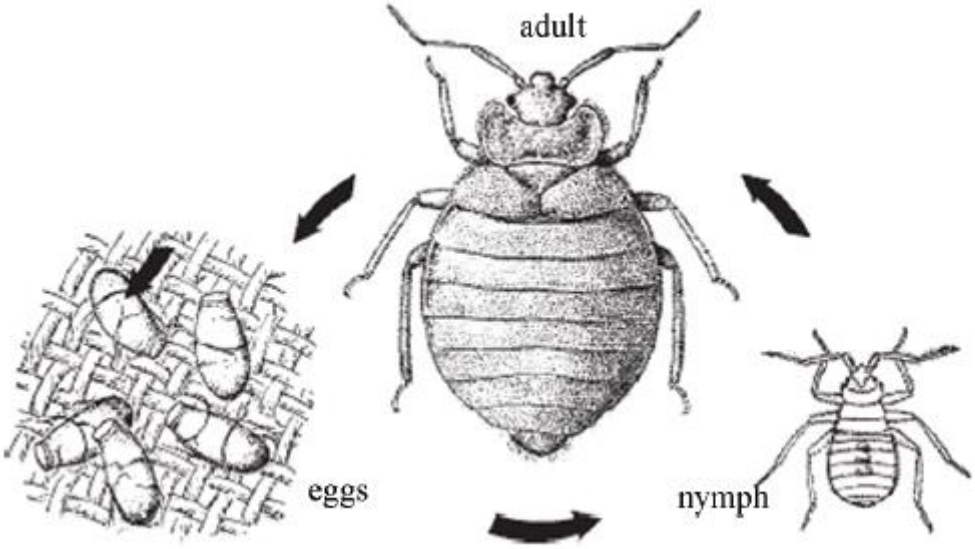

Figure 5.5: Life cycle of the bedbug.

5 Fleas

- There are different fleas like human, rat, cat, bird and dog fleas but they can all readily feed on other species in the absence of their primary host.
- The human flea infests houses with poor sanitation, especially those with a warm, earth floor and dark places. The adults live by biting and sucking blood.
- The bite is painful, disturbing and irritating. The fleas may be seen on the host animal or on bedding or clothing.
- Females require a fresh blood meal in order to produce eggs. Females lay 8–10 eggs in dark places. The eggs hatch within 2 days into larvae which feed on organic matter and develop into pupae. The life cycle takes 3–4 weeks.

- **It can be transmitted** murine typhus or endemic typhus disease.

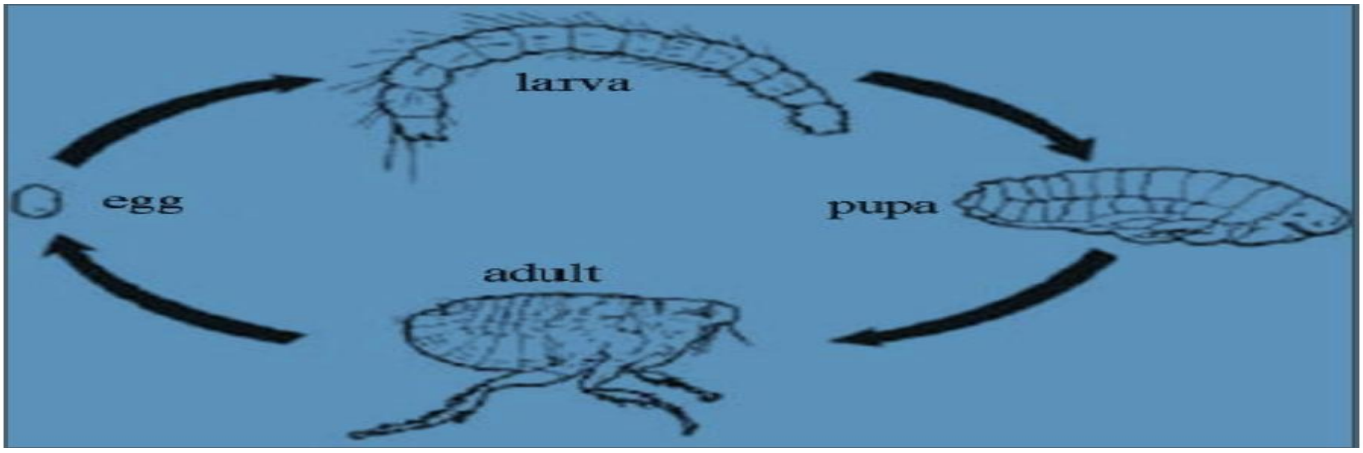

Figure 5.6: Life cycle of the flea.

6. Black Flies

- The developmental stages of black flies is the same as in mosquitoes (complete metamorphosis), demanding the existence of water for the eggs, larva and pupa.
- Eggs cling to aquatic and emergent vegetation. They are also found attached to the sides of canals in irrigation schemes, concrete dams and on aquatic animals.

- They feed on small aquatic organic matter like protozoa, bacteria, algae, fungal spores, pollen etc. Life cycle ranges from 60 days to 15 weeks or over.

- **The most important disease transmission** by black flies is **Onchocerciasis (**river blindness**).** Onchocerciasis is a dangerous disease of tropical Africa with blinding, visceral
  - ✓ Involvement and fatal effects and other disorders. Onchocerciasis is reported in south-western part of Ethiopia, around Jimma, Bonga, Shebe, Gore, Nekemte and Gardulla.

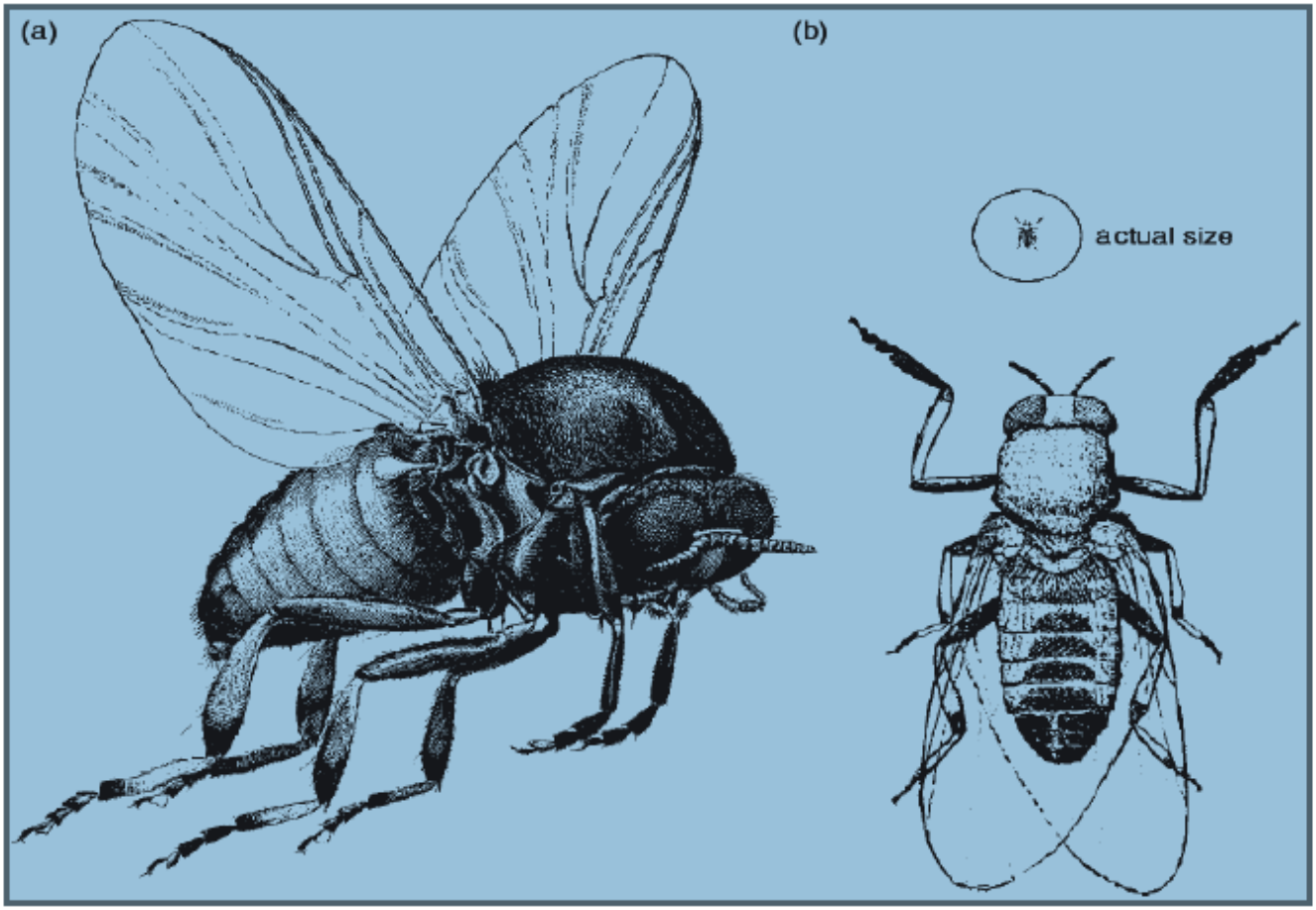

Figure 5.7: Black fly: (a) in flight and (b) at rest

7. Tsetse Flies

- The different species of tsetse flies occur in tropical Africa. They live both in dry and wet savannah regions. Their breeding sites and habitats are located close to rivers, streams and other bodies of water, mostly in trees, and bushes.
- The female tsetse fly does not lay eggs but produces larvae, one at a time. The larva develops in the uterus over a period of 10 days and is then deposited fully grown on moist soil or sand in shaded places, usually under bushes, fallen logs, large stones and buttress roots. It buries itself immediately and turns into a pupa. The fly emerges 22–60 days later, depending on the temperature.
- Females mate only once in their life and, with optimum availability of food and breeding habitats, can produce a larva every 10 days.

- **Tsetse flies transmit** the causal organisms of sleeping sickness (trypanosomiasis) to man and nagana disease to cattle.

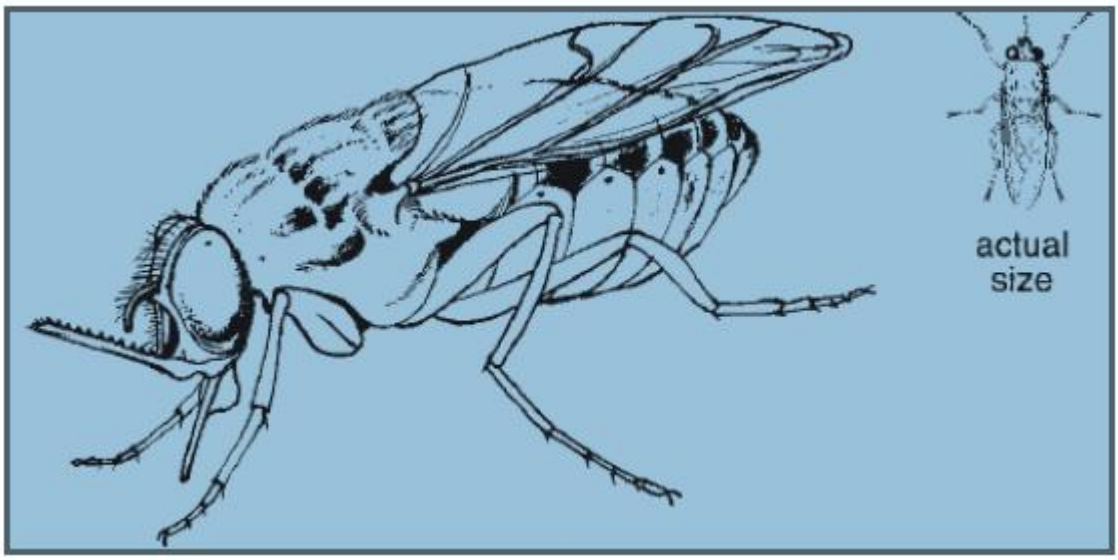

Figure 5.8: Tsetse fly; this shows a feeding fly with a swollen abdomen

8 Freshwater snails

- Many species of freshwater snail are intermediate hosts of highly infective fluke larvae of the genus Schist soma which cause schistosomiasis, also **called bilharziasis**.
- It is prevalent in areas where the snail intermediate hosts breed in waters contaminated by faeces or urine of infected persons. People acquire schistosomiasis through repeated contact with fresh water during fishing, farming (irrigating), and swimming, washing, bathing and recreational activities.
- People serve as vectors by contaminating the environment.
- Transfer of the infection requires no direct contact between snails and people. Freshwater snails are also intermediate hosts of food borne fluke infections affecting the liver, lungs and intestines of humans or animals.

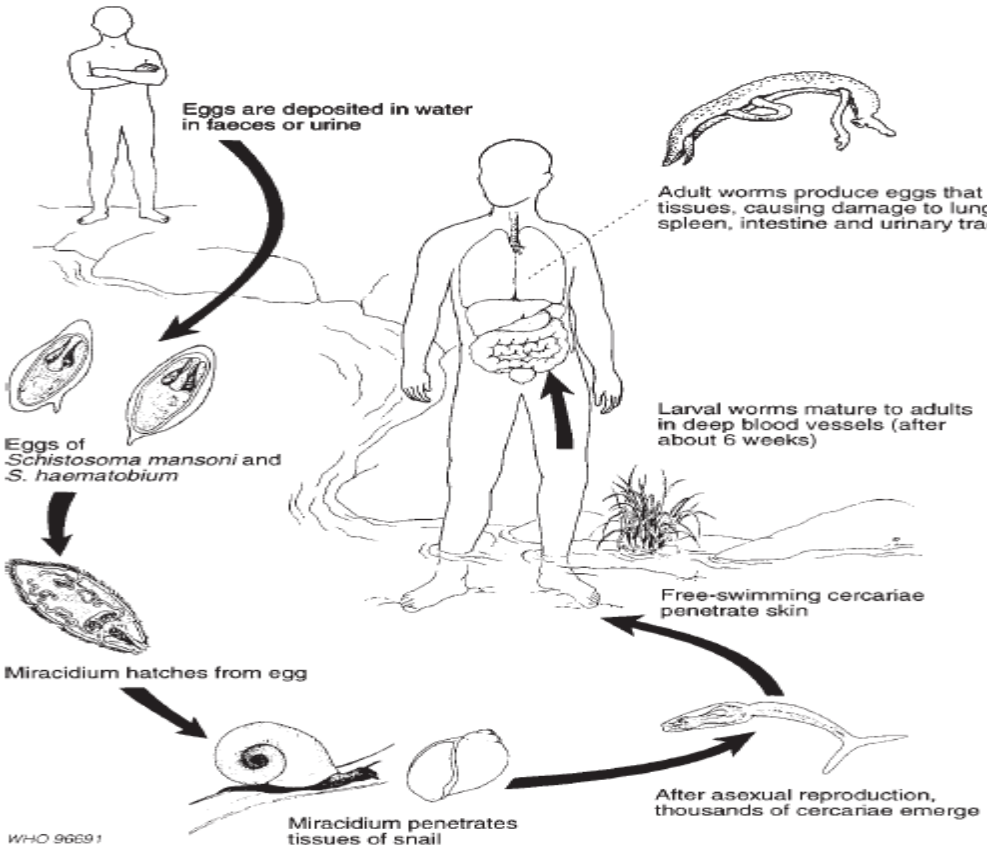

Figure 5.9: Life cycle of schistosomes

- **Prevention and control of schistosomiasis**
  - Improved detection and treatment of sick people;
  - Improvement of sanitary facilities for safe and acceptable disposal of human excreta
  - Provision of safe drinking-water;
  - Reduction of contact with contaminated water; and snail control.

3.5.3 Rodent

- Rodents are relatively small mammals with a single pair of constantly growing incisor teeth specialized for gnawing. The group includes rats and mice.
- Rodents are abundant in both rural and urban areas. They are found inside houses, in fields and around heaps of waste.

- **Three types of rodent are commonly associated with public health problems.**

1. Norway rats (*Rattus norvegicus*)

- Also known as the brown rat or sewer rat, Norway rats are most numerous in urban areas. They burrow and live in the ground, and in woodpiles, debris, sewers and rubbish.
- Norway rats are omnivorous, which means they eat a wide variety of foods, but they mostly prefer cereal grains, meat, fish, nuts and some fruits. They do not travel more than 100 metres in search of water and food. When Norway rats invade buildings, they usually remain in the basement or ground floor.
- They reproduce rapidly (4–7 times a year producing 8–12 young per litter with a gestation period of 22 days).

- The adult is relatively large in size, with a short tail and small ears. Their lifespan is 9–12 months.

2. Roof rats (Rattus rattus)

- Also known as the black or grey rat, roof rats are more numerous in rural areas. They live in roofs, and eat mainly grains.
- They are smaller than Norway rats with longer tails and ears. They are excellent climbers and usually live and nest above ground in shrubs, trees and dense vegetation. In buildings, they are most often found in enclosed or elevated spaces in attics, walls, false ceilings, roofs and cabinets.
- They usually nest in buildings and have a range of 30–45 metres. They can often be seen at night running along overhead utility lines or fence tops.
- Using their long tails for balance. The average number of litters a female roof rat has per year depends on many factors but generally is between three and five with 5–8 young in each litter.

3. Mice

- Mice are smaller in size than rats and generally prefer cereals to eat. They are excellent climbers and can run up any rough vertical surface.
- They will run horizontally along wire cables or ropes and can jump up to 30 cm from the floor on to a flat surface. Mice can squeeze through openings slightly larger than 1 cm across. In a single year, a female may have 5–10 liters of about 5–6 young.
- Young are born 19–21 days after mating, and they reach reproductive maturity in 6–10 weeks. The life span of a mouse is about 9–12 months.

- Behavior of rats
  - Rats are active at night. Although the vision of rats is poor, they have keen senses of smell and hearing, and a well-developed sense of touch via their nose, whiskers and hair.
  - They like the same food as people and prefer it fresh although they will eat almost anything.
  - Rats constantly explore and learn about their environment, memorizing the locations of pathways, obstacles, food and water, shelter and other elements in their domain.
  - They quickly detect, and tend to avoid, new objects placed in a familiar environment. Thus, objects such as traps and baits are often avoided for several days or more following their initial placement.
  - Both species exhibit this avoidance of new objects, it is usually more pronounced in roof rats than in Norway rats.
- Public health importance of rodents
  - Disease transmission: rats are the natural hosts of fleas that may carry bubonic plague and murine typhus or endemic typhus from an infected rat to a human.
  - Food damage: mice and rats will eat stored food, mainly grains, and will spoil food by leaving their droppings. One rat can consume 15 kilograms of food per year. Rats are estimated to destroy 20% of the world's crop production.
  - Material damage: gnawing by front teeth to doors, windows, wood, boxes, bags, clothes.

3.5.4 Vector Management and Control

- **Vectors can be controlled using various methods.**

1. Basic sanitation

- The approach targets the elimination or reduction of that part of the environment that facilitates breeding and harborage (places where vectors find refuge or shelter).

- It includes the elimination of all possible breeding places for insects, the prevention of stagnation of water to limit the breeding of mosquitoes, and proper solid waste management and use of a latrine to control the breeding of houseflies.
- The use of clean water from protected sources for drinking prevents the transmission of guinea worm. Rats are controlled by starving them and eliminating their breeding places. Personal hygiene contributes to the control of lice.
- Generally, a clean home and environment will prevent the breeding of insects. The use of ventilation, latrines and adequate water supply play a significant role in the control of insects.

2. Physical measures

- These include methods that stop vectors from getting into close contact with humans, and methods that are used to kill vectors.
- They include bed nets for mosquitoes and wire mesh for flies and mosquitoes Mosquito larvae can be controlled in some water containers by putting a thin layer of used oil on the surface of the water.
- The acts as a barrier between the water and the air so the larvae cannot access oxygen, and suffocate. Physical methods also include traps such as adhesives to control flies and traps for rats and mice
- Delousing by boiling or steaming infested clothes are physical methods for controlling lice.

Figure 5.10: Rat trapping (urban roof rat).

3 Use of chemicals

- Chemical insecticides can be used for the destruction of adults and larvae of insects. Commonly-used chemicals are DDT, malathion and pyrethrums.
- Pyrethrum-containing aerosols are used for the destruction of cockroaches and flies in our homes.
- Rodenticides can be used to kill rats and mice. The indiscriminate use of these chemicals, however, could have undesired health effects on users and domestic animals.
- Extreme care should be taken during the application and storage of chemicals. It is always important to look at the instructions for using the chemical. Environmental health

workers and veterinary technicians may be able to assist in the use of chemicals against vectors.

Figure 6.10 Insect killer chemical insecticide and fly swat.

4 Biological methods

- These include several very advanced methods that prevent the successful reproduction of pest species.
- They include the sterilization of males (tsetse fly, mosquito), sex distortion or replacement of genes.
- All of these methods are expensive and often complex to monitor. Other biological methods involve introducing or encouraging predators of the vector species.
- **For example**, small fish can be used to feed on larvae of mosquitoes. Reptiles, birds and frogs feed on adult insects and cats will prey on rats.

5 Integrated approaches

- Integrated vector management includes a combination of two or more of the above methods. This is often more effective than using a single method of control.
- **For example**, the rat population may be significantly reduced by combining starving with trapping. Sanitation can be combined with other cheap methods in order to be both sustainable and effective.

3.5.5. Planning for Improving of Vector Control

1 Knowing the scope of vectors

- You cannot tackle all types of vectors. However, you can be involved in the control of flies, lice, fleas, bedbugs and rats, which are the most important public health vectors. You will probably also be involved in mosquito control.

2 **Identifying the extent of the problem**

- Knowing the depth of the problem is important in order to mobilise the necessary resources to deal with it. This will also help you in setting priorities for vector control.
- You need to visit a few dwellings and ask which vectors disturb the family. You should find out how common each vector is in the community.

3 Identifying control methods

- Vector control methods vary depending on the species and you will need to use appropriate methods of intervention according to the above descriptions. Pay

attention to breeding site control through the provision of basic sanitation. The use of sanitation, with one or more other methods, is the preferred tool of intervention.

4 Identifying partners in vector management

- You will probably need to liaise with other people and offices to tackle vector problems.
- These may include local government institutions (for example, the police office for prison lice management; the school office for nits and lice management among students), local NGOs and community institutions (idir, traditional leaders). They could provide resources and advice, and help mobilize the people.

5 Designing the plan of action

- This requires the preparation of activities under a specified timeframe based on the identified problems.
- Such activities include: visiting houses, advocacy, public and individual education and conferences.

Self Check #5	Written test

Direction: Matching

"A"	**"B"**
------**1**) Louse	**A)** Onchocerciasis
------**2**) Sand fly	**B)** trypanosomiasis
-----**3**) Black fly	**C)** Leishmaniasis
-----**4**) Tsetse fly	**D)** Typhus fever
-----**5**) Fresh water snail	**E)** Schistosomiasis
	F) Rabies

Note: Satisfactory rating 5 points unsatisfactory below 5 points

You can ask you teacher for the copy of the correct answers

Answer Sheet

Score _____

Rating _____

Name: _____ Date: _____

Short Answer Question

1._____

2._____

3. _____

4._____

5._____

3.6 water supply and safety

3.6.1 Public health importance of water

- Satisfactory water supply must be available to all humans. by “satisfactory”, we mean water must be available in adequate quantity, be safe to drink and be accessible.
- Improving access to safe drinking water can result in tangible benefits to health.
- The great majority of water related health problems are the result of bacterial, viral, protozoan and other biological agents.
- Infectious water borne diseases such as diarrhea, typhoid and cholera are leading causes of death and illness in the developing world. There are many diseases associated with water.

3.6.2 Uses of Safe Water

- Safe water is water, which is free from disease-causing agents and does not have any risk to health over a lifetime of consumption.
- **Potable water**: - means water that is safe to drink.
- **Palatable water**: - which means water that is pleasant to drink. Palatable water is at a desirable temperature, completely transparent and free from tastes, odors and colors, but is not necessarily free from disease causing agents.
- Safe drinking water is suitable for all usual domestic purposes, including personal hygiene. Access to safe and affordable water is considered to be a basic human right.
- The provision of safe water and sanitation is not only essential for disease prevention, it is also a key mechanism required to break the cycle of poverty, particularly for women and girls.
- Lack of access to water may limit the use of latrines because the need for hand washing creates an additional water requirement and therefore an additional burden on the person responsible for collecting water.
- Improved access to safe water, women and girls have more time to tend to crops and livestock, more time and resources to spend on improved food preparation, more time to attend school, and an opportunity to participate in the local economy. These are all mechanisms for breaking the vicious cycle of poverty.

- **Purposes of water**

1. For drinking

- All individuals need water for drinking every day. Inadequate consumption of water, either by drinking or through food, can lead to dehydration of the body and ultimately to death. The water requirement of individuals for drinking and food preparation will vary according to diet, climate and the type of work they do.
- Pregnant women and breastfeeding mothers need more water than other people do. The minimum amount of water needed for survival ranges from about 2 litres per capita per day in temperate climates to about 4.5 litres for people in hot climates who have to carry out manual work.

2. For food preparation and cooking

- Water is an ingredient of many foodstuffs and is also needed for food hygiene to make certain that food is safe to eat. Most people need at least 2 liters of safe water per day for food preparation.

3. For hygiene and sanitation activities

- Providing safe water and encouraging people to practice good hygiene will achieve massive health benefits.
- For example, the Shigella bacterium causes dysentery or bloody diarrhoea and it is a major contributor to the millions of water-related deaths each year. However, the simple step of washing hands with soap and water will significantly reduce shigellosis and other diarrheal diseases.
- Providing clean water for washing can prevent trachoma, which is the leading cause of preventable blindness. Hand hygiene is important for our hands can be soiled by many different contaminants, while visiting a toilet, during farming activities, cleaning children's bottoms and so on.
- Hence washing hands with soap and water is very important for reducing communicable diseases.

4. Other purposes of water are like recreation, transportation, body temperature regulation and metabolism action facilitation, aquatic life preservation etc.

3.6.3 **Criteria for Satisfactory Water Supply**

- **Satisfactory water** means water that is available in adequate quantity, is safe to drink and is accessible. Human beings have a right to have clean and safe water. Several criteria need to be satisfied to ensure that the people in your community have satisfactory access to water.

▪ These include:

1 Sufficient Quantity

- According to international and national guidelines, the quantity of water available in each household should be 50 to 100 liters per person per day, or an absolute minimum of 20 liters.
- The amount is largely determined by the distance of the source of water from the home.
- If the water source is outside of the home, but within around 1 kilometer (30 minutes total collection time), about 20 liters per person per day will typically be collected. Where water is supplied through a single tap within the confines of the household's living area, the water used is typically about 50 liters per person per day.
- Households that do not have to travel to collect water have more time for economic activity, food preparation, childcare and education. Having access to a greater volume of water potentially encourages hand washing, general physical cleanliness and improved living conditions.

2 Safe and Acceptable

- Water must be safe for drinking and other household uses. Drinking water must be free from microbes and parasites, and free from chemical and physical contaminants that constitute a danger to a person's health. It must also be acceptable in terms of colour and odour.
- The river is likely to be contaminated with animal dung, urine and possibly other pollutants. It is not advisable to use this water for drinking and cooking without any treatment. The river is an unprotected source; there is nothing to protect the water from contamination.

Figure 6.1:- Animals come to the river to drink at the same place as the women collect the water.

3 Physically Accessible

- Water must be within safe physical reach, in or near the house, school or health facility.

- Accessibility to safe water can be classified as follows:

A. No access: - people do not have access to safe water when:

- The distance to the water source is more than 1 kilometer or more than 30-minute round trip
- The amount of water collected is very low (often below 5 liters per capita per day)

B. **Basic access: -** people have a basic level of access to safe water when:

- The distance to the water source is within 1 kilometer/30-minute round trip.
- The amount of water to be collected on average is unlikely to exceed 20 liters per capita per day.

Figure 6.2:- Public water points an example of basic access, assuming the user lives within one-kilometer distance.

C. Intermediate access: People have an intermediate level of access to safe water when:

- Water is provided onsite through at least one tap (at yard level).
- Average volume of water collected is approximately 50 liters per capita per day

Figure 6.3:- Provision of safe water for a household with a single tap – an example of intermediate access.

D. Optimal access: - people have optimal access to safe water when:

- Supply of water is through multiple taps within the house. Approximately 100–200 liters per capita per day or more is available.
- The daily minimum water requirement was between 2 and 4.5 liters per person per day according to climate conditions.
- Because the average consumption refers to water used for all household purposes including washing, cooking and cleaning as well as drinking and eating**.**

4 Affordable

- Water should also be reasonably priced and affordable for everyone. Buying water should not reduce a person‘s capacity to buy other essential goods. This means that essential amounts of water must sometimes be provided free according to the socioeconomic strength of the communities.
- Ensuring the affordability of water requires that services match with what people can pay. For example, in most rural communities of Ethiopia the government and other organizations freely provide protected water sources.

3.6.4 Barriers to provision of Safe Water

- Capacity and finance are the main factors that prevent the effective provision of water.
- Capacity means having the ability to do something so as to get water. It can be described in terms of the human, technological, infrastructural, institutional and managerial resources required at all levels from the individual through to national governance.
- Capacities have to be built within each of these levels and they should be institutionalized, meaning formal organizational structures will be needed to bring about effective change. Individuals and groups of people can act together informally but this is less likely to succeed.
- Local communities need to be empowered to build their capacity and use infrastructure effectively otherwise, the provision of safe water will be difficult.

1. Lack of Community Capacity and Engagement

- Engagement of local people is essential for finding sustainable solutions and increasing the chances of long-term success. People need to be made aware of the possibilities and have the autonomy to create their own favorable conditions within the community.

For example, they need to identify their own problems, prioritize them and put forward their own solutions.

- Considering cultural and societal norms of the community, the involvement of influential people, and the collaboration of local institutions and organizations are important. The participation of women is especially important to improve the success of project outcomes.

2 Lack of Technological Capacity

- Technological capacity includes both existing and new technologies.
- The provision of water and sanitation could be significantly improved with the wider application of existing technologies, if other constraints could be overcome.
- The benefits could be extended even further with the development and application of new technologies that help specifically with the provision of safe water at household and community level.
- The technologies need to be user-friendly and designed, so it is easy to understand how they should be effectively constructed, operated and managed.

3 Lack of Institutional Capacity

- Collaboration between different sectors of the population is required to plan and implement actions in a coordinated way.
- For example, the health sector, agricultural sector and local administrators should all work together. This collaboration is the basis for multi-sectoral approaches to ensure that planned goals are achieved to solve environmental, water and health problems.

4 Insufficient Financing

- Water and sanitation continue to suffer from severe underfunding. At a local level, the potential sources of finance are government, non-governmental organizations and others. You can try to make a difference firstly by understanding that these different potential sources of funds are and then working with your colleagues and others in the community to seek financial support.

Self check #6	Written test

Direction: - Choose the correct answer from the given alternatives

1. Water that is safe to drink

A) Potable **B)** Palatable **C)** Raw water **D)** None

2. The distance to the water source is more than 1 kilometer or more than a 30-minute round trip

A) Optimal access **B)** Basic access **C)** No access **D)** None

Note: Satisfactory rating 2 points unsatisfactory below 2 points

You can ask you teacher for the copy of the correct answers

Answer Sheet

Score _____

Rating _____

Name: _____ Date: _____

Short Answer Question

1._____

2._____

Information sheet #7	Introducing Water associated diseases

3.7 Water associated diseases

- **Several terms are used to describe the types of disease associated with water**.

1**. Water-borne diseases**:

- Are those caused by ingestion of water that is contaminated by human or animal excrement and contains pathogenic microorganisms?
- Transmission occurs by drinking contaminated water.
- Waterborne diseases include most of the diarrheal diseases caused by bacteria and viruses, including cholera, typhoid and bacillary dysentery. They also include diseases caused by protozoa such as giardiasis, amoebic dysentery and cryptosporidiosis.

2. **Water-washed diseases**:

- Are caused by poor personal hygiene, and skin and eye contact with contaminated water.
- They are also sometimes known as water-scarce diseases because they occur when there is not enough water available for adequate personal washing.
- They include scabies, trachoma, typhus, and other flea, lice and tick-borne diseases.

3. Water-based diseases:

- Are caused by parasites that spend part of their lifecycle in water.
- For example, schistosomiasis and dracunculiasis are both water-based diseases caused by helminthes (parasitic worms). Schistosomiasis (also known as bilharzia) is caused by a worm that spends part of its lifecycle in the body of a particular species of water snail.
- People can become infected when they are infected with infected water. Dracunculiasis or guinea worm is transmitted by drinking water that is contaminated with copepods (very small crustaceans) that contain the larvae of the worm.

4. Water-related diseases:

- Are caused by insect vectors, especially mosquitoes that breed or feed near water.
- They are not typically associated with lack of access to clean drinking water or sanitation services. Water-related diseases include dengue fever, filariasis, malaria, onchocerciasis, trypanosomiasis and yellow fever.
- Many million individuals in Ethiopia have to get their water from unsafe sources and this makes them vulnerable to waterborne disease.

5**. Chemical contamination of water:**

- In some places, water may contain naturally-occurring toxic chemicals such as arsenic and fluoride. Other chemicals may get into the water supply because of pollution.
- Lead poisoning, for example, can result from water contaminated with lead. These diseases are also classified as waterborne diseases.

Self check # 7	Written test

Direction: - Matching

"A"	**"B"**
1. Waterborne diseases	**A)** Onchocerciasis
2. Water-based diseases	**B)** Trachoma
3. Water-related diseases	**C)** Bacillary dysentery
4. Water-washed diseases	**D)** Schistosomiasis

Note: Satisfactory rating 4 points unsatisfactory below 4 points

You can ask you teacher for the copy of the correct answers

Answer Sheet

Score _____

Rating _____

Name: _____ Date: _____

Short Answer Question

1._____

2._____

3._____

4._____

Information sheet # 8	Promoting Treatment of Drinking Water at Household and Community level

3.8 Treatment of Drinking Water at Household and Community level

- The purpose of **water treatment** is to reduce or remove all contaminants whether biological, physical or chemical that is present in the water and to improve water quality. So that it is completely safe to drink. Water is unlikely to be completely free of contaminants at the original source.
- The types of water treatment processes depend on the characteristics of the **raw water.**
- Suspended particles, bacteria, algae, viruses, fungi, minerals such as iron and manganese, and fertilizers are among the substances that are removed during water treatment. **Suspended particles** are a tiny of solid material that are carried along or suspended in the water.
- Effective treatment should ensure the removal of all disease causing agents and so reduce the possibility of the outbreak of waterborne disease.

- **Water treatment systems can be categorized as:-**
  - Small-scale water treatment system, which includes community and household treatment methods.
  - Large-scale water treatment system that might be found in towns and cities.

1. Small-scale water treatment systems

- **Household level water treatment is appropriate when:**
  - A relatively small amount of water is obtained from a well or spring and is collected and transported by hand.
  - The source is contaminated and simple protective measures can neither improve water quality nor stop the contamination.
  - Community resources are inadequate to meet the cost of a simple community treatment system and make it difficult to develop a centralized treatment system.

1 Household sand filter

- Household filters are an attractive option for household treatment because these filters can usually be made from locally available and inexpensive materials like clay pots or barrels. They are simple and easy to use.
- The upper pot contains layers of sand and gravel. Water is poured in at the top and, as it passes through the layers of sand, any particles within it are filtered out. The thickness of the layers should be approximately 5 cm of gravel, 5 cm of coarse sand and 10 cm of fine sand.
- The bottom of the upper pot should be perforated (have tiny holes in it) so the clean water can drip into the lower pot. The lower pot should have a tap (faucet) to draw off the clean water easily.
- The sand and gravel should be changed when the rate of filtration starts to slow; at minimum, it should be changed every two or three months.

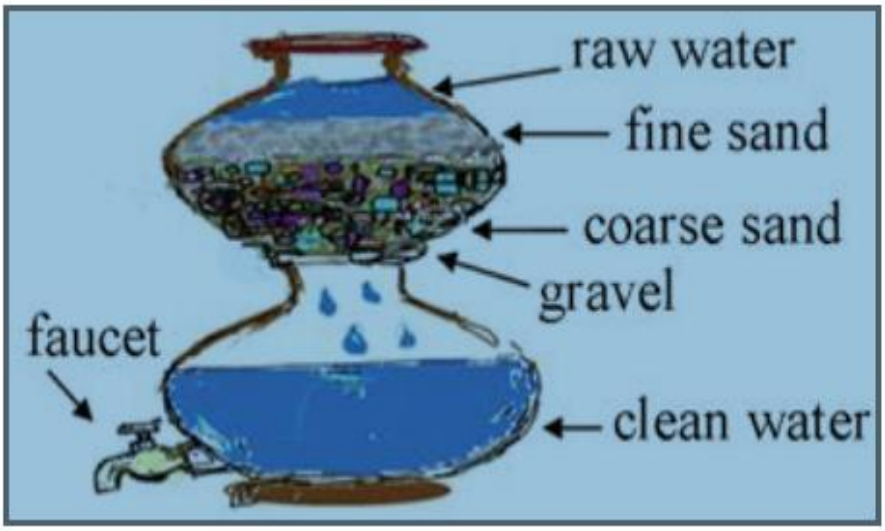

Figure 8.1: Household water filter using two clay pots placed on top of each other

2 .Cloth filtration

- Cloth filtration is a common water treatment technique that is easy to use and in expensive. Cloth filtration can be very effective against cholera, guinea worm (dracunculiasis) and other disease-causing agents.

- **The steps in cloth filtration are:**
  - Use a large cloth, preferably made of finely woven cotton.
  - The cloth must be big enough to easily cover the opening of the container once it has been folded.
  - Fold the cloth at least four times so there are multiple layers of fabric and place this over the opening of the storage vessel.
  - Fasten the cloth securely around the rim of the opening and tighten the string. If reusing the cloth, always use the same side up each time.
  - Filter all water immediately at source as it is being collected.
  - Always keep filtered water separated from non-filtered water.
  - Rinse the filter cloth after each use, with a final rinse using cloth-filtered water, and then leave the cloth in the sun until it is dry.
  - Clean the cloth regularly using soap and replace it as soon as there are any visible tears or holes.

Figure 8.2: Cloth filtration

3 Other filtration methods

- Other filtration methods such as ceramic filters and bio sand filters are not currently widely used in Ethiopia but are also appropriate for household and community use.
- Ceramic filters of various types have been used for water treatment throughout the world.
- The majority of bacteria are removed mechanically through the filter‘s very small (0.6–3.0 microns) pores. Ceramic filters are easy to use, relatively low cost and have a long life if the filter remains unbroken. They are good for reduction of bacteria and protozoa but lack residual protection so recontamination is possible.
- Bio sand filters differ from the other types of filter described above in that they make use of biological activity as well the mechanical filtering of particles. The most widely used version of the bio sand filter is a concrete container about one meter in height and filled with sand.
- The container is filled with water so the water level is above the sand layer. The water allows a bioactive ‘layer to grow on top of the sand. This bioactive layer consists of algae plankton and other microscopic plant life that helps reduce disease-causing organisms, particularly protozoa and bacteria.
- The bio sand filter is fairly easy to use, can be produced from locally available materials, needs little maintenance and has a long life but it has a high initial cost and is difficult to transport.
- It will improve the look and taste of the water and is good for removing protozoa but has a low rate of virus inactivation and does not remove 100% of bacteria so recontamination is possible.

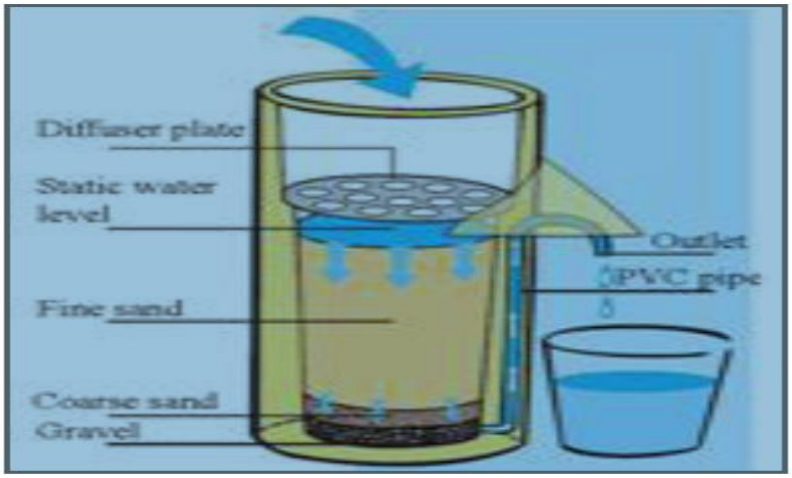

Figure 8.3:- Bio sand filter.

4. Solar disinfection

- Solar disinfection, also known as SODIS, relies on energy from the sun to kill pathogenic organisms, especially bacteria. Ultraviolet light from the sun is an effective bactericide for water.
- This simple technique requires only a few plastic bottles and sunlight. Firstly, collect several bottles (0.3 to 2.0 liters) made of clear plastic, remove all labels and wash them thoroughly.
- Fill the bottles with water of low turbidity and shake for about 20 seconds to aerate the water. Expose the bottles to the sun by placing them on a roof or rack for at least six hours (if sunny) or two days (if cloudy). The water is now ready to drink.

❖ **The benefits of solar disinfection include**:

- ✓ Proven reduction of bacteria, viruses and protozoa
- ✓ Acceptability to users because of the minimal cost to treat water, ease of use and minimal change in water taste
- ✓ Unlikely recontamination because water is consumed directly from the small, narrow-necked bottles (with caps) in which it is treated.

❖ **The drawbacks include**:

- ✓ Requires relatively clear water (if the water is too cloudy it has to be filtered first)
- ✓ Only a limited volume of water can be treated at one time
- ✓ The length of time required to treat it.

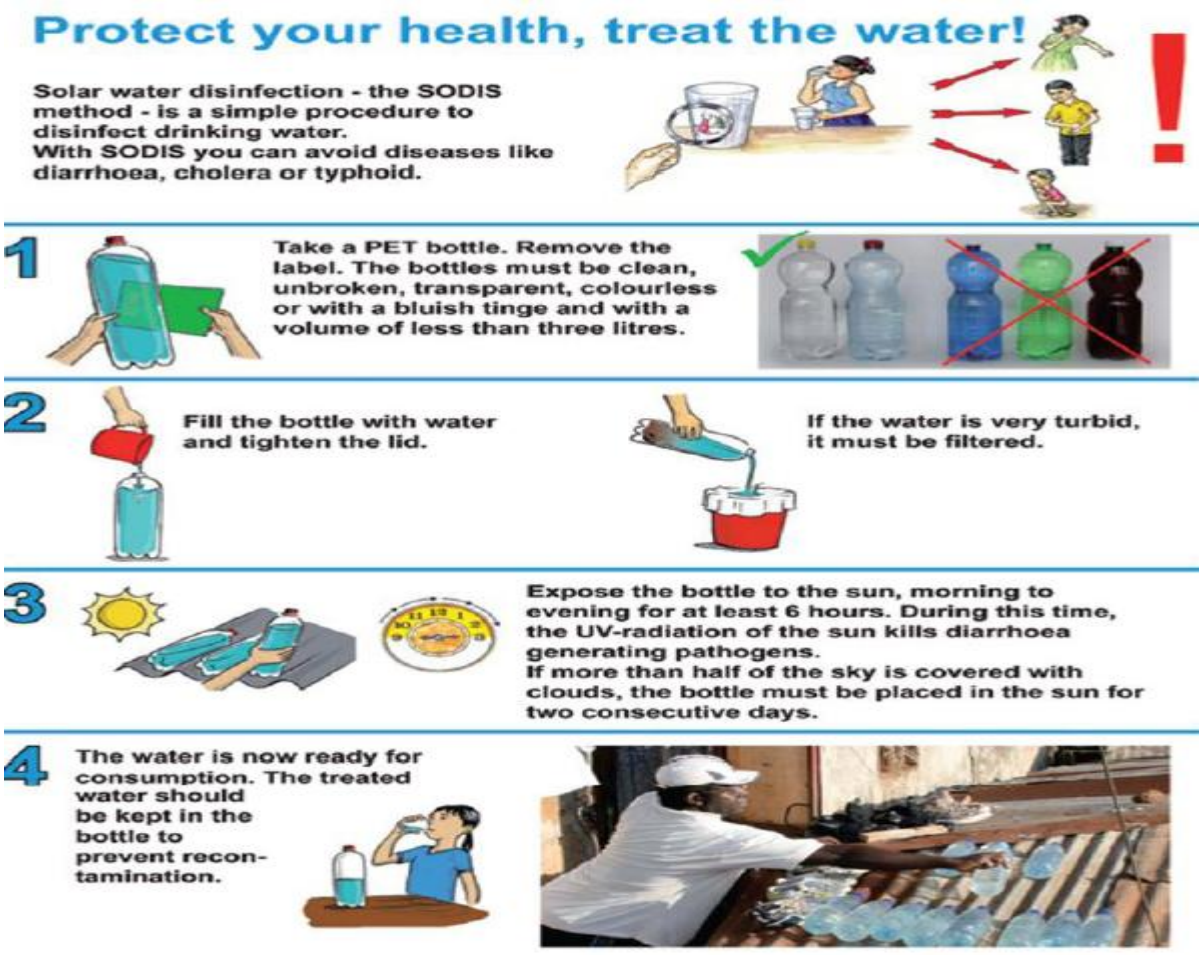

Figure 8.4: The SODIS method of water treatment.

5 Chemical disinfection methods

- There are several commercially available products designed for treating water at household level.

A. Chlorine solution

- ➢ Chlorine solution, also known as sodium hypochlorite solution or bleach, is the most affordable, easiest to produce, and most widely available chemical for household water treatment.
- ➢ It is supplied in bottles and has easily interpretable instructions for use on the side of the bottle.

- The procedure is to add a capful of chlorine solution to a 25 liter water storage container, then shake and wait for 30 minutes chlorine contact time before drinking. Double dosing is advisable if the water is visibly dirty or highly turbid.

B. Aqua tabs

- Aqua tabs are a specifically formulated and branded solid form of sodium dichloro iso cyanurate (NaDCC). NaDCC is stable in Aqua tabs form as a solid, which gives it a longer shelf life and makes storage, handling and transport much easier than with liquid bleach.
- One Aqua tab contains 67 mg of NaDCC and treats 20 litres of clear water. For visibly turbid water, two tablets per 20 liters are needed. It is very important to mix well and leave for 30 minutes contact time before consumption.

C. PUR

- PUR Purifier of Water‘is the brand name of a combined flocculants and disinfectant product produced by Procter and Gamble. It is now on the market in Ethiopia although it may not be widely available across the country. PUR can be used to treat raw source waters with a wide range of turbidity and pathogen load.
- This water treatment chemical allows flocculation to take place and helps to remove Giardia and Cryptosporidium cysts that are resistant to chlorine disinfection. (A cyst is a dormant stage in the life cycle of some protozoa and bacteria that is resistant to adverse environmental conditions and therefore difficult to destroy.)
- PUR comes in sachets with one sachet needed to treat 10 litres of water.

Figure 8.5: Aqua tabs tablets for household water.

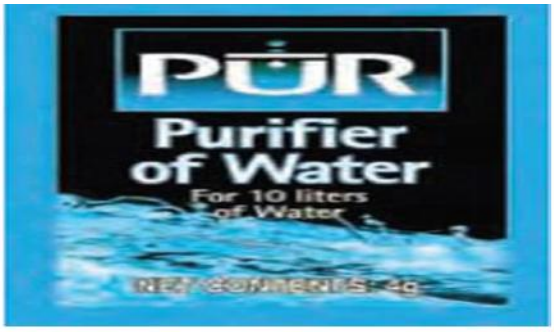

Figure 8.6: PUR Purifier of

Water treatment

D. “Wuha Agar”

- Wuha Agar is a chlorine-based water treatment solution that is used in Ethiopia . The procedure is very similar to other chemical treatment methods. For a 20 liters jerrycan, add one capful of Wuha Agar, cover and shake. After 30 minutes contact time, you can use it.

Figure 8.7: Wuha Agar for household water treatment

6. Boiling

- Boiling is also an optional water treatment at household level. Boiling is a simple way of killing any ova (eggs), cysts, bacteria and viruses present in contaminated water.
- Water should be heated until large bubbles are continuously coming to the surface of the water. The disadvantage of boiling as a treatment method is that it requires large amounts of fuel so cost may prevent people from using this method.
- Boiling may give an unpleasant taste to the water which may be unacceptable and very hot water can cause accidents in the home. Boiled water can become decontaminated once it has cooled.

7. Safe Storage

- The type of treatment method is used, it is essential that water is stored safely and hygienically. Even if water has come from an improved source, this will not guarantee that it is safe because contamination can occur in the household due to poor storage and handling practices.
- The principal health risk associated with household water storage is the ease of recontamination, particularly where the members of a family or community do not all follow good hygiene practice.
- Safe storage is especially designed to eliminate sources of recontamination by keeping objects, including hands, out of the system.
- It is important to recognize that unsafe water is not made safe just by using safe storage methods. Safe storage helps to ensure that post-treatment recontamination does not occur within the household.

Figure 6.8: Safe storage containers.

II. Large-scale Water Treatment System

- Large-scale or municipal water treatment is not common in rural communities but you may find it in larger towns and cities where there is a network of pipes and pumps to distribute water from the treatment works.
- There are several steps in municipal water treatment intended to remove solids, kill pathogenic organisms and make water safe to drink.

- **Large scale water treatment is appropriate when:**
  - A water source serves a larger population than can be served by household level or individual treatment systems.
  - A community water source is contaminated and simple protective measures can neither improve water quality nor stop the contamination
  - Community resources are adequate to cover the cost of construction, operation and maintenance of a simple community level treatment system.

- **The main stages are usually**

1. Aeration

- Means to mix air with the water. It is used to remove volatile (easily evaporated) substances from drinking water. Air and water are put into contact with each other, i.e. air is bubbled through the water, so that the volatile substances are evaporated into the airstream and removed from the water.
- Aeration can be carried out in towers or aeration basins to provide the necessary contact time between air and water.

2. Coagulation:

- Is the formation of particles in a liquid by adding chemicals? Its meaning is similar to flocculation.
- The flocculants used in large-scale treatment plants is usually alum (hydrated aluminum sulphate). This chemical is mixed with turbid water and then allowed to remain still in a sedimentation tank or basin so that the larger particles, or floc, settle to the bottom.

3. Sedimentation

- Is the settling out of comparatively heavy suspended material (suspended solids) in water because of gravity. The settling takes place in a quiet pond or a specially constructed tank.
- A minimum 24-hour retention time is necessary to have a significant reduction in suspended matter. (Retention time means the length of time the water is kept (retained) in the tank.)

4. Filtration

- Is the removal of suspended material from water as it passes through beds of porous material? This is exactly the same principle as filtration methods at household level. Filters can be made of layers of sand, gravel or charcoal. Filtration cannot completely remove all bacteria.

5. Disinfection

- Kills most harmful organisms including pathogenic bacteria. Without disinfection, the risk from waterborne disease will remain. Disinfecting agents include chlorine, ultraviolet light, ozone, iodine and others but, of these, chlorine is the most frequent treatment agent. The process is called chlorination.

6. Chlorination

- Used at both household and large-scale levels, is one of the most effective and widely used methods for disinfecting water and making it safe to drink. Whatever the level, it is important that the correct quantity of chlorine is added to remove all impurities.

Figure 6.9: Sedimentation tank at a municipal water treatment works.

- **At municipal level, various terms are used to describe aspects of the chlorination process**.
  - **Chlorine dosage** is the amount of chlorine added to the water system in milligrams per liter (mg/l).
  - **Chlorine demand** is the amount of chlorine that combines with the impurities and therefore is no longer available as a disinfecting agent.
  - The chlorine that remains in the water after the chlorine demand has been satisfied is called **free chlorine residual.** A certain amount of residual chlorine is a good idea because it protects against future recontamination.
  - **The orthotolidine-arsenite test (OTA)** is used to determine the amount of free chlorine residual. When orthotolidine reagent is added to water containing chlorine, a greenish-yellow color will appear.
  - The intensity of the color is measured against a chart to determine the amount of free available residual chlorine in the water. The amount of residual chlorine needs to be in the range of 0.2–0.5 mg/l if it is to prevent recontamination with bacteria.
  - The OTA test requires a special test kit. If required, this should be available from your district environmental health office.
- **The benefits of point-of-use chlorination include:**
  - Chlorine is proven to be effective in the reduction of bacteria and most viruses.
  - The residual chlorine is effective in protection against recontamination.
  - It is easy to use.
  - Chlorine is easily available at low cost.
- The drawbacks of chlorine treatment include:
  - It provides relatively low protection against some viruses and parasites.
  - Lower effectiveness in water contaminated with organic and certain inorganic compounds.
  - Potential objection to taste and odour

- Some people have concerns about the potential long-term carcinogenic effects of chlorination byproducts.

Self check #8	Written test

Direction: - Choose the correct answer from the given alternatives

1. The water treatment chemical allows flocculation to take place.

A) Wuha Agar **B)** PUR **C)** Aqua tabs **D)** Chlorine solution

2. One of the following is the drawbacks of solar disinfection.

A) Requires relatively clear water. **C)** Limited volume of water can be treated.

B) The length of time required to treat it. **D)** All

Note: Satisfactory rating 2 points unsatisfactory below 2 points

You can ask you teacher for the copy of the correct answers

Answer Sheet

Score _____

Rating _____

Name: _____ Date: _____

Short Answer Question

1._____

2._____

3.9 Community Drinking Water Source Protection

3.9.1 Sources of Drinking Water

- The sources of drinking water that are practicable for public and domestic purposes are:-
  1. Rainwater
  2. Surface water (such as lakes, rivers, streams and ponds)
  3. Groundwater (e.g. springs wells and boreholes.)

1. Rain water

- Rainwater is reasonably clean and safe for drinking if properly collected from clean catchment (roof) surfaces.
- Rainwater is the main source of water domestic purposes in arid and semi arid areas like Somalia, afar, some areas of Wello and Borana where there are no alternative sources of water.
- Rainwater harvesting is simply means collecting, or harvesting, rainwater as it runs off from hard surfaces such as rooftops and storing it in a tank or cistern.
- Rainwater can be harvested in storage tanks (roof catchment), dams and ponds by surface catchment.
- The mean annual rainfall amount in mm, the catchment surface area, the water consumption amount, and the seasonal pattern of rainfall is necessary to design the required catchment and amount of water needed for the dry season when there is no rainfall.
- Using rainwater can reduce the burden on women and children who typically are the water carriers in Ethiopia and walk long distances to fetch inadequate supplies

Figure 9.1:- Rainwater is collected from the roof of this health centre and stored in a covered, Water tight.

2. Surface Water

- Surface water supplies are taken from rivers, lakes or ponds. Surface water can provide a consistent and manageable source of water. However, it is subject to greater risk of contamination than groundwater and therefore usually requires treatment.

- It's likely to be polluted by industrial & municipal effluents affecting the water physical, biological and chemical characteristics. Contamination is most likely to be with microbiological pathogens from human and animal excreta.

- **Surface Water Sources of contaminants/pollutants**
  - All surface water sources are subject to continuous or intermittent pollution and must be treated to make them safe to drink. One never knows when the organisms causing diseases such as typhoid fever, gastroenteritis, giardiasis or infectious hepatitis A will contaminate surface water sources.
  - The extent of the treatment required will depend on the results of a sanitary survey made by an experienced professional, including physical, chemical, and microbiological analyses.
  - Protecting surface water from pollution is difficult because, as noted earlier, the activities of upstream users of the river water will affect the quality of the water for downstream users and the land use in the surrounding area will also have an impact. Surface waters are, by definition, unprotected sources.

Figure 9.2: A surface water source that is likely to be polluted.

3. Groundwater

- Ground water is that portion of the rainfall water which has percolated into the earth until it reaches an impermeable stratum‖. Therefore, Groundwater is water found beneath the ground surface held in the spaces within porous soil and rock.
- The depth that water is taken from and the types of rock it has passed through are important factors that affect the quality of the groundwater.
- Groundwater, particularly from deep sources, may provide water of good microbiological quality. This is because bacteria, protozoa, viruses and helminthes are filtered from the water as it passes through the layers of soil and rock into the groundwater.
- Ground water is likely to free from contamination and pollution; does not need treatment plants if properly protected (a protected well, spring); can be accessed for individuals where it is abundant Groundwater sources are therefore preferable to surface water sources.
- Groundwater can contain chemical contaminants, such as arsenic, fluorides and nitrates.

A. Springs

- A spring occurs at the point where the boundary between a permeable layer of underground rock and an impermeable layer reaches the ground surface.

- Rainwater percolate (trickles down) through the soil into permeable layers of subsoil or underground rock. The downward percolation will be stopped if this layer sits on top of an impermeable layer and the water can go no further.
- Depending on the slope of the layers, the water will run along the top of the impermeable layer to a point where it reaches the surface and emerges as a spring.
- A spring may vary in volume and contamination levels according to the amount of rainfall.
- Springs are likely to be polluted by direct contamination through the topsoil unless the surrounding land area is protected.
- A spring supply issuing from a deep, water-bearing layer, rather than a permeable layer near the surface, can produce both a consistent volume and a better quality supply.
- The spring originates from shallow or deep rock layers, animals should be excluded from the surrounding area by a stock-proof fence, and any water running off the land after rain should be diverted to a suitable ditch away from the spring.

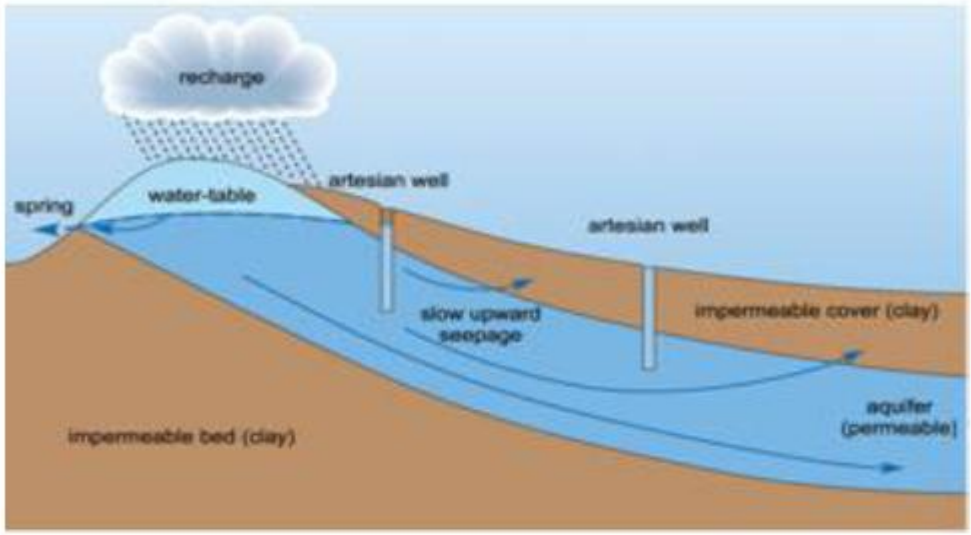

Figure 9.3: Diagram of groundwater formation with spring and artesian wells.

B. Wells

- The practice of obtaining water from wells is common and well water is an important source of supply in many developing countries like Ethiopia.
- A well should be located uphill from any possible sources of pollution. It is less possibilities of contamination when we contrast with surface water sources. However it should be protected from external floods, use sanitary ropes and buckets and always fenced or covered with barrel covers

- **Wells are classified based on the depths of the water-bearing layers as follows:**

1. **Shallow wells**
   - Tap into water held in aquifers (layers of water-bearing rock) above the first impermeable layer. Shallow is not a definite depth, but an indication of the layer of rock from which it is abstracted.
2. **Deep wells**
   - Obtain water from aquifers below at least one impermeable layer. A deep well must be constructed so as to exclude subsoil water and contamination from above.
   - It should be watertight down to a point slightly below the level of the deep supply.

3. Artesian supply

- Water in aquifers is sometimes under pressure because of the surrounding impermeable layers and this can cause the water to flow upwards to the surface.
- The water level in the two artesian wells is determined by the level of the water table. In the well on the right, water rises to the land surface but in the well on the left, it does not.

- **Contamination of Well Water**
  - **The causes of bacterial contamination in a well are usually due to:**
    - ✓ Lack of, or improper, disinfection of a well following repair or construction.
    - ✓ Failure to seal the space between the drill hole and the outside of the casing.
    - ✓ Failure to provide a tight sanitary seal at the place where the pump line(s) passes through the casing.
    - ✓ Waste water pollution caused by contaminated water percolating through surrounding soil and rocks into the well.
    - ✓ At the time when a new well is constructed or repairs are made to a well, pump or piping, contamination from the work is possible. Therefore, it is important that the well, pump, piping and associated structures should be regularly disinfected using chlorine solution.
- **Tracing the source of contamination**
  - There are different methods which help to identify a possible source of groundwater contamination. One method is sodium or potassium fluorescein. This is a brightly colored, fluorescent, water-soluble dye and can be used as a tracer when a sewage disposal system is suspected of contaminating groundwater. A solution flushed into the disposal system or suspected source may appear in the well water within 12–24 hours

3.9.2 Protection of Wells

- Before and during water source development care should be taken to minimize possible risks. The well should be located on a higher level than possible sources of contaminants such as latrines and cesspits (a pit for collection of waste matter and water especially sewage). This is because the liquid from the pit may seep into the surrounding ground and into the groundwater.
- If the latrine is higher up a slope than the well then the contaminated groundwater is likely to flow downwards and into the well.
- The natural flow of the groundwater (the hydraulic gradient) should be away from the well and towards the sources of contaminants, and not the other way round.
- In normal soils, the minimum distance between the well and the source of contaminants should never be less than 15 meters and a distance of 30–50 m is recommended. However, for limestone and some other soil formations this distance need to be greater because groundwater can pass very easily through some rocks and soils.
- The inside wall of the well should be made waterproof by constructing a well casing. As noted above, in small diameter bored wells, the casing can be a pipe but in larger wells, the casing needs to be constructed by cementing from the top of the well down to a minimum depth of 3 meters.
- The casing of the well should also be extended for a minimum of 60 cm above the surrounding ground level to prevent the entrance of surface runoff.
- A concrete cover should be fitted over the casing to prevent dust, insects, small animals and any other contaminants from falling in.
- A pump should be installed, but if a pump is not available then a sanitary bucket and rope system may be used.

- The immediate area of the well should preferably be fenced to keep animals away The area surrounding the well should be graded off i.e. should be sloped away from the well, in order to prevent the flow of storm water into the well.

Figure 9.4: Two wells with concrete protection.

3.9.3 Spring Water Source protection

- There may not be many opportunities to develop new spring sources but, if the opportunity does arise, there are certain procedures to follow to ensure the spring water is protected and safe to drink.
- You would be working with others if a new spring source was to be developed but the same principles will apply to existing spring sources because the protection needs to continue to work into the future.
- Before using a spring, a thorough sanitary survey needs to be carried out at the site to assess the quantity and quality of water and the possible contamination.
- If the results of the sanitary survey are satisfactory, the eye of the spring (the point where the water emerges from the ground) should be located by digging out the area around the spring down to the impermeable layer.

- **Different types of spring protection can be constructed but in general they are as follows:-**
  - A concrete waterproof protection box, also known as a spring box, should be constructed over the spring to prevent all actual and potential sources of contamination.
  - A retention wall in the front part of the protection box should be constructed to keep water flowing to the delivery pipe. You can see the retention wall of this spring with the delivery pipe emerging from it.
  - In some situations, if the flow is not constant, a collection box may also be constructed in order to ensure adequate water storage. The intake and overflow pipes should be screened to prevent the entrance of small animals.
  - The spring and collection box, if there is one, should have a watertight top, preferably concrete. Water will move by gravity flow or by means of a properly installed mechanical pump. An inspection hole should be tightly covered and kept locked.
  - Springs should be protected from flooding and surface water pollution by constructing a deep diversion ditch above and around the spring.
  - The ditch should be constructed so it collects surface water running towards the spring and carries, or diverts, it away.
  - The surrounding area should be fenced to protect it from animals

Figure 9.5:- A protected spring, Note the concrete retention wall with two delivery pipes and the surrounding fence.

Self check # 9	Written test

Direction: - Choose the correct answer from the given alternatives

1. From the following which one are the key measures to control spring pollution

A) Dig a diversion ditch above the spring **C)** Build a fence to keep animals away from the spring.

B) Design and build a protection box **D)** All

2. Water found beneath the ground surface held in the spaces within porous soil and rock.

A) Groundwater **B)** Surface water **C)** Rainwater **D)** lakes

Note: Satisfactory rating 2 points unsatisfactory below 2 points

You can ask you teacher for the copy of the correct answers

Answer Sheet

Score _____

Rating _____

Name: _____ Date: _____

Short Answer Question

1._____

2._____

Information sheet # 10	Introducing Water pollution and its Control

3.10. Water pollution and its Control

3.10.1 Sources of water pollution

- Water is a good solvent. This is the reason why many different chemical substances are found dissolved in water. Gases in the atmosphere will dissolve in rainwater as it passes through the air. By the time water reaches a stream or river, it will contain a variety of chemical compounds dissolved within it from the air and from the rocks and soil through which it has percolated.
- These compounds may be completely harmless naturally occurring substances but they may also include pollutants.
- Pollution can be defined as the introduction into the natural environment (air, water or land) of substances (pollutants) that are liable to cause harm to human health or to animals, plants and the wider environment.
- Water pollution occurs when a river, lake or other body of water is adversely affected due to the addition of pollutants. Water quality can be affected by pollution from point sources and non-point sources. Point sources are identifiable points or places, such as a pipe or channel, which discharge directly into a body of water.
- This might be from wastewater treatment plants, factories and industrial plants, latrines, septic tanks or piped discharge from barnyards and other places where livestock are confined.
- Non-point sources are those where pollution arises over a wider area and it is often difficult to locate the exact place of origin. For example, fertilizer or pesticide washed from a field by rain may seep into a river or stream at many places both on the surface and through the soil.
- Pollution from non-point sources, also known as diffuse pollution, contributes most of the contaminants in rivers and lakes. Other non-point sources are pollution from construction sites and other land disturbances. The problems in identifying the exact point of origin make non-point sources much more difficult to control.

Figure 10.1:- Washing Lorries and cars in rivers is a source of water pollution.

3.10.2 Types of Water Pollutants

1. Sediments and suspended solids

- Sediments consist of fine particles of mostly inorganic material such as mud and silt washed into a stream as a result of land cultivation and construction.

- They may also arise from demolition and mining operations where these activities take place. The presence of solid particulate material suspended in the flowing water is the reason why many rivers look brown in colour, especially in the rainy season.
- The particles are called suspended solids while they are carried (suspended) in flowing water. When they settle to the bottom, they are called sediments.
- Large quantities of inorganic matter, in the form of suspended solids, may reduce light penetration into the water which can affect the growth of plants.
- Sediments may even suffocate organisms on the river bed. River water may also contain organic matter, such as human and animal wastes, which can deplete (reduce) the oxygen in the water if the river is slow-flowing
- This can lead to anaerobic conditions which may create unsightly conditions and cause unpleasant odours.

2 Nutrients

- Phosphorus and nitrogen are common pollutants generated from residential areas and agricultural runoff, and are usually associated with human and animal wastes or fertilizer.
- Nitrogen and phosphorus are plant nutrients required by plants to grow. They are spread on farmland in the form of fertilizers.
- Rain washes these nutrients into rivers, streams and lakes. If the nutrients are present in large quantities, they can encourage excess plant growth in the water causing the phenomenon known as an algal bloom, which means a sudden increase in the population of microscopic algae.
- If a water body has high nutrient levels it is said to be eutrophic; the process is called eutrophication.
- The main problem of eutrophication is that the suddenly increased population of aquatic plants can die off equally quickly. The decay of the plant material by bacteria can cause deoxygenation of the water.

3. Biological pollutants

- Biological pollutants are microorganisms (bacteria, viruses, protozoa and helminths) that are harmful to humans and other forms of life.
- Infectious diseases caused by biological pollutants, such as typhoid and cholera, are the most common and widespread public health risks associated with drinking water.
- Microorganisms may get into water with dust from the air as rain falls, and when water passes through soil which is polluted with human and animal wastes.
- The contamination of water supplies with raw sewage (human and domestic wastes generated from residential areas) is the most common route for biological pollutants to enter water.
- When contaminated river water moves downstream it is possible that any pollutant will be diluted as more water flows in and so increases the total volume of water in the river. This dilution may be enough to reduce the contaminants sufficiently to minimize the possible health effects but this process may not work for all pathogens.

- **Bacteria**
  - Many different types of bacteria are found in fresh water. They are not all pollutants because many are not harmful in any way and play a valuable role in the natural breakdown of organic matter and the cycling of nutrients. Other bacteria however, as you have learnt in other sessions, are pathogens and are the cause of many waterborne diseases.
  - The presence of faecal coli form bacteria in drinking water, and E.coli in particular, can indicate a possible presence of harmful, disease-causing organisms.

- **Viruses**
  - Enteric (intestinal) viruses are produced by infected persons and excreted in faeces.
  - Viral contamination may come from sewage effluent discharged into a river or from open defecation by an infected person who may be washed by rainwater to a river or stream. Some enteric viruses are resistant to chlorination.
  - The common waterborne viruses are polio, hepatitis A and rotavirus. The presence of any enteric virus in water bodies can be taken as an indication of the possible presence of other harmful viruses.
- **Protozoa**
  - There are several protozoa that can be discharged into water bodies from infected persons. For example, Cryptosporidium and Giardia are common problems in rural parts of Ethiopia.
- **Helminths**
  - Helminths or parasitic worms can also cause ill health in humans. Infection occurs through ingestion of the helminth eggs which may be present in food.
  - For example, helminth eggs may be present in the meat of cattle grazing on land contaminated by faeces.

4 Chemical pollutants

- **Heavy metals**
  - Arsenic, copper, lead, mercury and cadmium are chemical pollutants that may be found in lakes, rivers and groundwater. Fortunately these are not common problems in rural Ethiopia. These heavy metals can harm aquatic organisms and humans.
  - Farmers who use river water polluted by urban wastes for irrigation of fruits and vegetables may find their crops affected by the accumulation of these chemicals.
- **Pesticides**
  - Pesticides include insecticides, herbicides and fungicides. There are several thousand different types in use and almost of them are possible causes of water pollution.
  - **For example**, DDT, malathion, parathion, delthametrine and others have been sprayed in the environment for long periods of time for the control of disease vectors such as mosquitoes, and to control the growth of weeds and other pests.

- **Types of pollutant defined by their source**
  - Pollutants from certain sources may be a mixture of the types described above and therefore need a separate category because they combine several possible impacts. Municipal wastewater and agricultural wastes are in this category.
  - Municipal wastewater is generated from residential areas and often contains high concentrations of organic matter, phosphorus and nitrogen, pesticides, toxic chemicals, salts, inorganic solids such as silt as well as pathogenic bacteria and viruses.
  - Agricultural wastes are generated from livestock and poultry farming and from growing crops. They can be the source of many organic and inorganic pollutants in surface waters and groundwater.
  - Agricultural wastes include sediment from erosion of cropland, and phosphorus and nitrogen compounds that originate in animal wastes and commercial fertilizers.
  - Animal wastes require oxygen to be broken down in water bodies and can also harbor pathogenic organisms.
  - The extensive use of fertilizers and pesticides in agricultural regions means that both surface and groundwater are affected by these pollutants.

3.10.3. Public Health Importance of Water Pollution

- Waterborne infectious diseases are transmitted primarily through contamination of the water sources with excreta of humans and animals who are either active cases or carriers of disease.
- Carriers do not show any signs of disease although they have disease-causing agents in their body that can be transferred to others; active cases are people who are displaying visible signs of disease.
- Use of contaminated water for drinking or cooking, or contact with contaminated water during washing or bathing may result in infection.
- The dose or amount ingested that is necessary to cause illness depends on the type of pathogen.
- Exposure to a single pathogenic organism does not always result in infection and disease. Sometimes many pathogens, perhaps several hundred, must be ingested to cause infection.
- The minimum infectious dose also varies with the age, health, nutritional and immunological status of the exposed individual. Infants and young children, people who are debilitated, people who are living in unsanitary conditions, people who are sick and the elderly are at greatest risk of waterborne diseases.

3.10.4 Indicators of water pollution

- The physical, chemical and biological characteristics of water are changed when the water is contaminated with different pollutants.
- Water is colorless, odorless and tasteless, as you know, but when it is polluted with physical and chemical pollutants the water may have color, odor and taste.
- To know whether water is polluted with specific bacterial contaminants; samples should be taken and sent to a laboratory for analysis.
- E.coli is the standard indicator organism for faecal contamination of water and for the possible presence of faecal pathogens.
- For water intended for drinking, the World Health Organization (WHO) recommends that E.coli must not be detectable in any 100 ml sample. In most developing countries like Ethiopia the essential is to get from ‘bad’ quality (more than 1,000 faecal coliforms per 100 ml) to ‘moderate’ quality (less than 10 faecal coli forms per 100 ml). ‘Good’ quality is classed as zero faecal coli forms per 100ml.

3.10.5 Prevention and control of water pollution

- The control of pollution should ideally take place at the point of generation or, in other words, it should be prevented at source. As you have learned from the sanitary survey, you should look out for possible sources of pollutants in your locality.
- The control of excess nutrients is an important issue both from a public health perspective and to keep natural waters free from eutrophication. An increasing proportion of water pollution originates from diffuse (non-point) sources, such as agricultural use of fertilizers. Farmers may need guidance on good agricultural practices that will help reduce water pollution from agriculture.
- For example, the amount of fertilizer used and the timing of its application can make a significant difference.
- Pollution prevention is best achieved by ensuring that each potential point source is properly sited, designed, constructed and managed; the aim being to contain the pollutants and prevent their uncontrolled release to the environment. Sources of pollution should be sited as far from watercourses as possible (at least 15 m away) and below any water sources on the site.
- Appropriate use of excreta disposal, solid waste disposal and animal waste disposal will help prevent contamination of both surface and groundwater.

- Springs usually become contaminated when latrines, animal yards, sewers, septic tanks, cesspools or other sources of pollution are located on higher land nearby.
- In areas with limestone rocks, contaminated material can enter the water-bearing channels in the rock and descend through cracks and holes or other large openings and may be carried along with groundwater for long distances.
- Other rock types can have a similar effect so it is important to have knowledge of the local geology to assess the probability of groundwater contamination.

❖ **Key preventive measures that will help to ensure that spring water is of a consistently high quality?**

- Dig a diversion ditch above the spring that will take surface water away from it.
- Build a fence to keep animals away from the spring.
- Design and build a protection box for the spring that will prevent contamination.
- Monitor the condition of the spring and the quality of the water regularly.
- For rainwater harvesting, pollution control means proper maintenance of the roof and gutters and careful cleaning at the beginning of every wet season.
- Some form of mesh should be placed between the guttering and the pipe that leads to the storage tank to prevent the entry of coarse debris; it then becomes important to clean the screen regularly to prevent blockage.
- The worst fouling of roofs occurs when they are situated under trees in which birds roost. A rainwater storage tank should be completely covered and well maintained. The catchment area of the water source is the total area of surrounding land that slopes towards the source.
- Water can become polluted from sources in the catchment even though they may be some distance away. Ideally, the whole catchment area should be protected to avoid pollution and erosion.
- Preserving the vegetation in the surrounding area can help protect the spring from pollution and from siltation caused by soil erosion.

▪ **Sampling methods for bacteriological testing**

- During the course of an investigation into a disease outbreak or as part of routine monitoring, you may be required to take water samples to be sent for microbiological or chemical analysis.
- It is important that samples are taken carefully and correctly to ensure they can be used for an accurate assessment of the condition of the source. When water samples are collected for analysis, you should take care to ensure that there is no external contamination of the samples. Glass bottles, rather than plastic, are best used for sampling.
- Both bottles and stoppers (caps) must be sterilized. Bottles should be clearly labeled with the place where the sample was taken and the date.
- You should be able to obtain sample bottles from your regional public health microbiology laboratory or your local environmental health office. You may need to take water samples from a tap, river, lake, water tank or dug well and each has a slightly different procedure to follow.

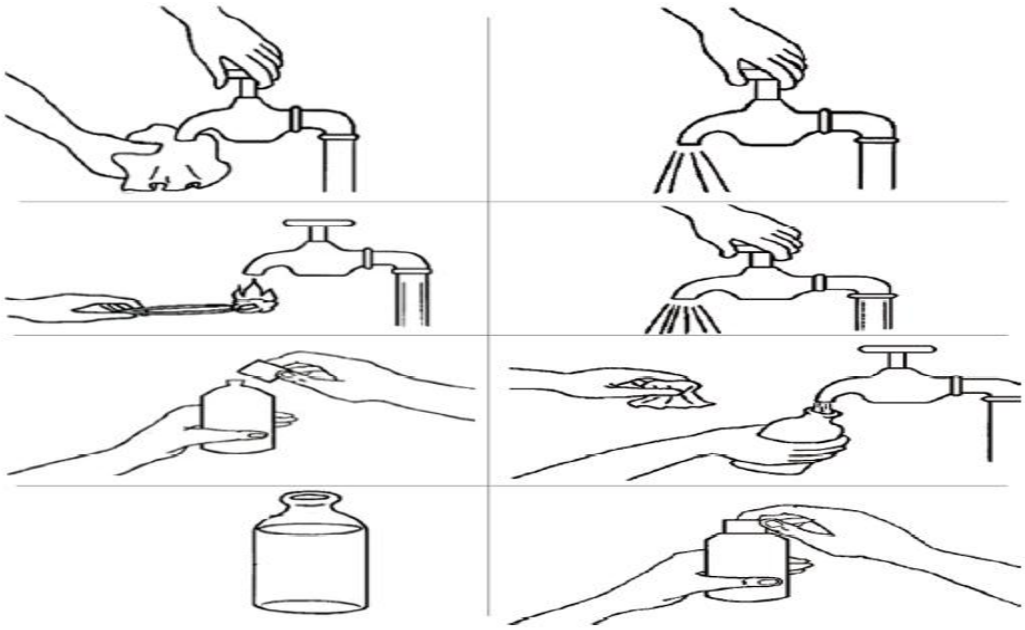

Figure 10.2: Procedures for sampling water from a tap.

Self check #10	**Written test**

Direction: say “True” or “False”

1. Take water samples & sent to the laboratory for bacteriological analysis.

Note: satisfactory rating 1 point unsatisfactory below 1 point

You can ask you teacher for the copy of the correct answers

Answer Sheet

Score _____

Rating _____

Name: _____ Date: _____

Short Answer Question

1._____

Operation Sheet #1	Performing hand washing

Steps for water sampling

1. Clean the tap/outlet using a clean cloth to remove any dirt.
2. Open the tap and turn on at maximum flow and let the water run for 1 to 2 minutes; then turn it off.
3. Sterilize the tap for a minute with the flame from a cigarette lighter, or an ignited alcohol-soaked cotton-wool swab.
4. Open the tap again and allow the water to flow for 1 to 2 minutes at medium flow rate.
5. Open a sterilized bottle by carefully unscrewing the cap or pulling out the stopper.
6. Immediately hold the bottle under the water jet and fill.
7. While filling the bottle, hold the cap face downwards to prevent entry of dust, which may contaminate the sample.
8. Place the stopper in the bottle or screw on the cap. A small air space should be left to make shaking before analysis easier.

LAP Test	Practical Demonstration

Instructions: Given necessary templates, tools and materials you are required to perform the following tasks within 5min.

Task 1: Perform water sampling

Instruction Sheet	LG19: Provide information on food and drink hygiene and safety

This learning guide is developed to provide you the necessary information regarding the following **content coverage** and topics:

- Promoting Food Hygiene and Safety
- Identifying Food Born Diseases
- Promoting Food Protection and Preservation
- Educating Hygienic requirements of Food and Drink Establishments
- Identifying Hygiene and safety requirements for food of Animal Origin

This guide will also assist you to attain the learning outcome stated in the cover page. Specifically, **upon completion of this Learning Guide, you will be able to**:

- Promote Food Hygiene and Safety
- Identify Food Born Diseases
- Promote Food Protection and Preservation
- Educate Hygienic requirements of Food and Drink Establishments
- Identify Hygiene and safety requirements for food of Animal Origin

Learning Instructions:

1. Read the specific objectives of this Learning Guide.
2. Follow the instructions described below 3 to 6.
3. Read the information written in the information “Sheet 1, Sheet 2, Sheet 3 and Sheet 4”.
4. Accomplish the “Self-check 1, Self-check t 2, Self-check 3 and Self-check 4” **in page -6, 9, 12 and 14** respectively.
5. If you Learned a satisfactory evaluation from the “Self-check” proceed to “Operation Sheet 1, Operation Sheet 2 and Operation Sheet 3 ” **in page -15.**
6. Do the “LAP test” **in page – 16** (if you are ready).

Information Sheet-1	Promoting Food Hygiene and Safety

4.1. Food Hygiene and Safety

4.1.1 Principles in Food Hygiene and Safety

Hygiene: - is the set of practices associated with the protection of health. Important feature **food hygiene** refers to many practices that needed to maintain the quality of food from production to consumption.

Food Hygiene: - means all conditions and measures necessary for ensuring the safety, wholesomeness, and fitness for consumption of food at all its stages i.e. from its production, processing, storage, distribution preservation, and service. (WHO/FAO).This is referred to as from "farm to fork" or "from farm to table", because it includes every stage in the process from growing on the farm, through harvesting, storage and distribution, to finally eating the food. It also includes the collection and disposal of food wastes.

Food safety is a scientific discipline describing handling**,** preparation and storage food in ways that prevent food borne illness. This includes a number of routines that should be followed to avoid potentially severe health hazards. The tracks within this line of thought are safety between industry and the market and then between the market and the consumer. In considering industry to market practices, food safety considerations include the origins of food including the practices relating to food labeling, food hygiene, food additives and pesticide residues, as well as policies on biotechnology and food and guidelines for the management of governmental import and export inspection and certification systems for foods. In considering market to consumer practices, the usual thought is that food ought to be safe in the market and the concern is safe delivery and preparation of the food for the consumer.

- F**ood hygiene: -** refers to the practices that prevent microbial contamination of food at all points along the chain from farm to table.
- **Food safety: -** is a closely related, but broader concept that means food is free from all possible contaminants and hazards.
- A traditional way of eating food at the household level in Ethiopia, injera with wot (sauce), is Usually this type of meal is safe, because it is a food that is prepared to eat immediately.

- **The five key principles of food hygiene, according to WHO, are:**
  1. Prevent contaminating food with pathogens spreading from people, pets, and pests.
  2. Separate raw and cooked foods to prevent contaminating the cooked foods.
  3. Cook foods for the appropriate length of time and at the appropriate temperature to kill pathogens.
  4. Store food at the proper temperature.
  5. Do use safe water and cooked materials
- **The specific objectives for food hygiene are to:**
  - Prevent food spoilage i.e. changes that make food unfit for consumption due to microbial or chemical contamination
  - Inform and educate people about simple and practical methods of keeping food safe to protect them against food borne diseases.
  - Protect food from adulteration (intentional contamination).

- Ensure proper practice in the food trade to prevent the sale of food that is offensive or defective in value and quality

- **Food**

  Food is any solid or liquid, when eaten and absorbed by the body produce energy, promotes the growth and repair of tissue; promotes resistance against diseases or maintains and regulates these processes. Food consists of edible materials such as meat, bread and vegetables; it may be raw (like fresh fruit) or cooked, processed or semi-processed. Food is a nutritious substance eaten by us to maintain our vital life processes. It is a fundamental need, a basic right, and a prerequisite to good health

- **Kinds of Food**

  a) **Perishable foods:** food items that have a short storage life and will become spoiled or contaminated if not preserved and handled properly e.g. fish, meat, milk; eggs, vegetables; creamy cake; and the like.

  b) **Semi-perishable foods:** food items that have a medium storage life and will become spoiled or contaminated if not preserved and handled properly bread, fruits

  c) **Non-perishable foods (stable foods):** foods which are not easily spoiled or contaminated e.g. dry foods; canned foods; sugar and cereals.

  d) Wholesome food: food, which is sound, clean and free from harmful ingredients – it is suitable for human consumption.

  e) **Food hazard:** food that is contaminated with biological, chemical or physical agents and, if eaten, will cause ill health.

- **Classifications are important for:**

  a) Proper storage identification

  b) Food service to the consumer's safety needs

  c) Identification the food media for bacterial growth

  d) Identification of food hazard and critical control points

- **Food that is not safe to Eat**

  - Although food is essential for life and good health, there are some foods that are not safe to eat.
  - Food must be labeled correctly. When any label, writing or other printed or graphic matter on a food container is false or misleading this is known as **misbranding**.
  - Misbranding violates food safety regulations and is unlawful.

- **Food labeling should include the following facts about the food:**

  - ✓ Character (type of food)
  - ✓ Origin (country)
  - ✓ Constituents or ingredients (what is in the food)
  - ✓ Amount in the container
  - ✓ Date of production and expiry date (this is the date when the food is no longer safe to eat)

  - **Adulteration** is when the normal content of the food has been intentionally changed by adding something to it that is not essential or minimizing something that is essential for nutritive value, for example, diluting milk with water and selling it as whole milk. Adulterated food could be unsafe for a number of reasons. These include poor nutrition, for example, watered-down milk is not as nutritious as whole milk. Unsafe ingredients may have been used, for example, unclean water or other harmful ingredients might have been added.

- **Contamination** is the undesired presence of harmful microorganisms or substances in food. Food can be contaminated by unhygienic practices in storage, handling and preparation and may compromise food safety and palatability.
- **Potentially hazardous food** is sometimes used to describe perishable foods because they are capable of supporting the rapid growth of microorganisms. If microorganisms are allowed to multiply, this will have the potential to cause disease if the food is eaten.

4.1.2 Principles of Safe Food Preparation

- **The key principles for safe food preparation are outlined below**.
  - Choose foods that are not easily damaged by transportation, accidents or by storage.
  - Cook foods thoroughly, especially meat because this can help to kill any microorganisms that might be present in the food
  - Eat cooked foods immediately after they are cooked, rather than leave them out and eat later
  - Delays in eating cooked food can lead to the growth and reproduction of microorganisms in the cooked foodstuff.
  - Store cooked food carefully at an appropriate temperature.
  - Either it should be kept cold, ideally in a refrigerator, or it should be kept hot.
  - If food must be reheated, be sure to reheat it thoroughly.
  - Avoid contact between raw and cooked food.
  - Wash hands properly before handling food and before eating.
  - Keep all kitchen surfaces and utensils meticulously clean.
  - Protect food from animals including insects, rodents and other animals.
  - Use safe water in food preparation and for washing fruits and vegetables to be eaten raw.

4.1.3 Food Contamination and Spoilage

A. **Food Contamination**

1. **Microbial food contamination**
   - Prevention of microbiological contamination is an important function in food preparation

- **Avoiding microbial food contamination**
  - Food handlers should follow these strategies:
  - Thorough hand washing before and during food preparation, especially after using the toilet, and handling raw food or waste.
  - Soap/ash sanitizer and clean water should be available for hand washing at convenient locations.
  - Sick food handlers should not prepare food! One sick person can cause a food borne disease outbreak, particularly where people are in crowded or unsanitary living conditions.
  - Raw and cooked foods should be separated, because raw foods are a source of microorganisms and can decontaminate prepared foods.

2. **Chemical contamination of food**
   - Attention also needs to be given to possible chemical contamination of food. Food can be contaminated through the misuse or mistaken handling of chemicals, including pesticides, bleach and other cleaning materials.

- All chemicals (detergent, disinfectant, sanitizer) used in the food preparation area should be removed before food preparation begins, to prevent any chemical contamination of the food.

- **possible sources of chemical contamination are:**
  - Reusing containers which have been used for chemicals
  - Using chemical sprays (e.g. to kill cockroaches) in areas where food is exposed
  - Accidentally adding chemicals, which have a texture similar to table salt or sugar during food preparation; they should always be stored separately.

B. Food Spoilage

- Food spoilage: is alteration of food in color, odor, taste, and texture, consistency due to food decomposition, decaying, rotten, and fermentation.
  - ✓ Food spoilage makes the food unsuitable, unhealthy, and undesirable for eating. It is of more aesthetical than disease causing (contaminated food). It is the reciprocal of fresh food‘.
- Causative agents of food spoilage (Etiology): bacteria fungi, insects, food enzymatic action (autolysis), reaction with the surrounding of (food oxidation)
- Conditions for food spoilage: aerobic condition, suitable temperature, suitable pH, moisture, time exposure.
- Health impact of food spoilage: food shortages and degrade the dignity of freshness i.e. food wholesomeness leading to unacceptable by consumers.
- Food spoilage is the process of change in the physical and chemical properties of the food so that it becomes unfit for consumption. Food spoilage is any undesirable change in food.
- Most natural foods have a limited life: for example, fish, meat, milk and bread are perishable foods, which mean they have a short storage life and they easily spoil. Other foods also decompose eventually, even though they keep for a considerably longer time.
- The main cause of food spoilage is invasion by microorganisms such as fungi and bacteria.
- Spoiled food is not only the problem of health but also has economical crisis when we dispose the unhealthy food items because of poor handling or the autolysis conditions.

4.1.4. Factors affecting Food Spoilage

- The growth of microorganisms in food products can be affected by extrinsic and intrinsic factors:

A. Extrinsic Factors

- Extrinsic factors are factors in the environment external to the food, which affect both the microorganisms and the food itself during processing and storage.
- Extrinsic factors include temperature, humidity and oxygen.

B) Intrinsic Factors

- Intrinsic factors exist as part of the food product itself.
- For example, meat has certain characteristics that may promote the growth of certain microorganisms.
- PH, Moisture content, Nutrient content, Structure of food items are the common intrinsic factors that affect the growth and multiplication of microorganisms in foods.

4.1.5 Infectious agents and Food Diseases

- Infectious agents are organisms that can be transmitted from one person to another person in the chain of infectious disease transmission. Those infectious agents that can cause diseases are often referred to as pathogens (pathogenic 'means disease causing).
- Many infectious agents (bacteria, viruses, fungi and protozoa) are microorganisms that are too small and cannot be seen with the necked eyes, except with a microscope.
- The adult stages of disease-causing parasites (helminthes or worms) may be seen with the naked eye, but their eggs and immature stages are seen only with microscope. Microbiology is the science that deals with the study of microorganisms.
- Although infections often result in disease, it is also possible to be infected with a pathogen and still appear healthy. Either this is the disease has not yet had time to develop, or the person's immune system is keeping it under control.
- The infectious agent can still be transmitted to others, example spreading into food that handled by infected food handlers.
- The majority of food borne diseases (those caused by infectious agents transmitted to people in the food we eat) are due to bacteria, but viruses, parasites and toxins are also can cause food borne diseases. Food contamination is the conditions of food that pathogenic micro organisms grow and multiply on it.

- **Bacteria**
  - Bacteria are the most abundant of all organisms. Bacteria are unicellular organisms (made of one cell) and are very small in size, ranging from 0.5 to 5.0 micrometers (μm).
  - Bacteria reproduce asexually. This means that they do not need a partner to reproduce, but simply divide into two, producing two new bacteria.
  - There are pathogenic bacteria capable of causing human illness and food spoilage, but there are also beneficial species of bacteria that are essential to good health and a healthy environment.
  - For example, beneficial bacteria live in our gut and help us digest our food; some bacteria are used to produce foods such as yoghurt and cheese; and others break down wastes in the environment.
  - Some bacteria are capable of forming highly resistant and endurable structures called spores. Spore form bacteria are resistant to heat, freezing, drying, chemicals and other adverse environments.
  - The spores can survive the normal processes of food storage and preparation. Two examples of spore-forming bacteria important in food contamination are Bacillus and Clostridium.
  - Temperature, humidity, oxygen and water are important for bacteria to grow and multiply. Under favorable conditions a growing bacterial population can double at regular intervals ranging from about 15 minutes to several hours.
  - The numbers of bacteria in food can increase rapidly and soon become hazardous to health, particularly if the food has a favorable temperature and water content..
- **Avoiding Food Contamination**

- You now know that food can be contaminated from sources in the natural environment, people, food preparation surfaces and utensils, raw and uncooked food, animals, pests and waste material.
- To prevent contamination, food production and preparation operations need to be carefully controlled.

4.1.5 Routes of Microbial Contamination of Food

- Bacteria are a major source of microbial contamination of food, i.e. the undesired presence in food of harmful microorganisms or the harmful substances they produce. Viruses, parasites and fungi are also able to contaminate food and cause food borne illnesses in humans.

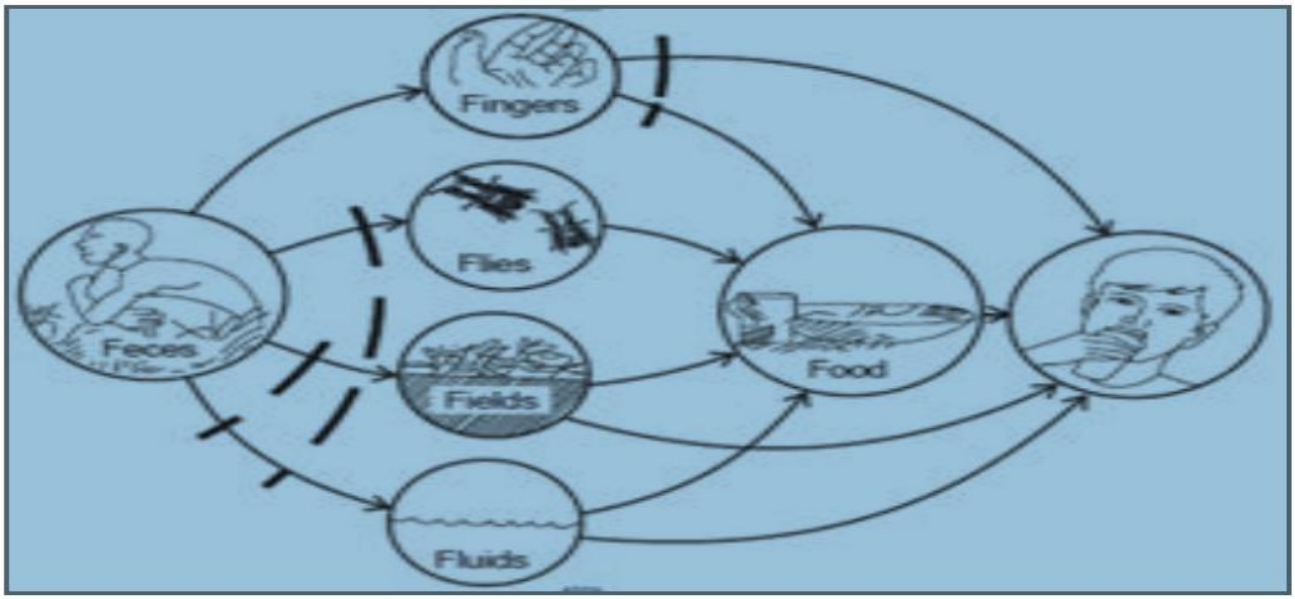

Figure 1.1:- Routes of disease transmission

- **Rout of microbial contamination includes:**

1. Air and Dust

- Microorganisms are found everywhere in our environment. Many types can be found in air and dust and can contaminate food at any time during food preparation or when food is left uncovered.
- Imagine a kitchen where food is prepared and stored in rural communities, and think how easily microorganisms in the air and dust could contaminate the food.

2. Soil, water and plants

- Many microorganisms present in soil and water may contaminate foods. Microorganisms also grow on plants and can contaminate food if care is not taken to remove them by washing or inactivate them by cooking.
- Soil is a particularly rich source of Clostridium bacteria. Faces may contaminate water. Faces may also contaminate plants if untreated sewage has been used as a fertilizer.

3. Gastro Intestinal Tract (GIT)

- The intestines of all humans and animals are full of microorganisms, some of which are beneficial but others are pathogenic. Bacterial pathogens such as Salmonella, Campylobacter and Escherichia coli are common examples.
- Contamination of foods by faecal material is the major cause of food poisoning events. This includes indirect contamination, for example from people‘s hands if they prepare food without washing their hands after visiting the latrine/toilet.

4. Food handlers

- The term food handler can be applied to anyone who touches or handles food, and this includes people who process, transport, prepare, cook and serve food.
- The presence of microorganisms on the hands and outer garments of food handlers reflects the standard of hygiene in the environment and the individuals 'personal hygiene.
- The microorganisms transmitted to foods by food handlers may come from the hides of animals, soil, water, dust, gastrointestinal tracts and other environmental sources.
- In food preparation at home, food borne microorganisms can be introduced from the unwashed hands of people who are infected by bacteria and viruses, and who cook and serve the food to family members.

5. Food utensils

- Food utensils are cutting boards, knives, spoons, bowls and other equipment used in food preparation, which may become contaminated during food processing and preparation.
- For example, in families where there is no access to running water, the food utensils may not be properly cleaned, stored and handled, and may become a major route of food contamination.

6. Cross-contamination

- Cross-contamination of food is the transfer of harmful microorganisms between food items and food contact surfaces.
- Raw food products and microorganisms may contaminate prepared food, utensils and surfaces. These can be transferred from one food to another by using the same knife, cutting board or other utensil without washing it between uses.
- A food that is fully cooked can become re-contaminated if it touches raw foods or contaminated surfaces or utensils that contain pathogens.

▪ **For example, you should never:**

- Allow raw meat to touch cooked meat
- Put cooked meat on a cutting board that has just been used for raw meat without cleaning it first
- Store raw meat on a shelf above cooked meat so that it could leak blood

7. Poor personal hygiene

- Poor personal hygiene of food handlers is another major factor in food contamination and similarly poor hygiene of consumers also.
- The most important contaminants of food are the 0microorganisms excreted with faeces from the intestinal tract of humans. These pathogens are transferred to the food from faecal matter present on the hands.
- We have already mentioned failure to wash hands after visiting a toilet as a source of food contamination. Can you suggest other times when food handlers should wash their hands?
- Hands should be washed before starting work on preparing food, and after touching any food, surface or equipment that may be contaminated (e.g. after handling raw meat).
- Bad personal habits like scratching your hair and nose with your fingers also contribute to food contamination. Sneezing and coughing spreads contaminants and microorganisms through the air and on to uncovered food, and on to surfaces and hands that can transfer the infectious agents into food.

8. Pests

- Foods can be damaged and also contaminated by pests. Many stored grains are lost through the damage done by pests, including termites (mist), beetles, locusts, cockroaches, flies and rodents such as rats and mice.
- Pests can damage and contaminate foods in various ways like boring into and feeding on the insides of grains, or tunneling into stems and roots of food plants.
- For example, weevils cause large losses of stored grains, especially in warm and humid conditions such as in lowland areas of Ethiopia.
- Pests also damage the protective skin of foods allowing microorganisms to get inside the food and causing it to rot re quickly.
- Pests can pollute food with their excreta and with bodies and body fragments when they die. They also transfer microorganisms on to food while walking on it.
- Flies and cockroaches readily move between wastes and foods, transporting microorganisms with them as they go.
- Domestic animals like cats and dogs can contaminate food, food stuffs and food utensils if not protected to reach.

Figure 1.2:- Insects can leave dirt, excreta and possibly pathogenic microorganisms if they are allowed to move slowly on food

4.1.7 Communication and Education

- Your principal role in food control is to communicate with your community and educate people about food hygiene. You may also have responsibility for inspection of food and drink service establishments.
- Effective food control must combine training, education and community outreach programmers with the effective enforcement of legal requirements.

Self check #1	Written test

Direction: Matching

"A"	"B"
1) Adulteration	**A.** Dry foods & canned foods
2) Non-perishable foods	B. Bread & fruits
3) Perishable foods	C. Diluting milk with water
4) Semi-perishable foods	D. Meat, milk & creamy cake
	E. Food Spoilage

Note: Satisfactory rating 4 points unsatisfactory below 4 points

You can ask you teacher for the copy of the correct answers

Answer Sheet

Score _____

Rating _____

Name: _____ Date: _____

Short Answer Question

1._____

2._____

3._____

4._____

4.2 .Food Born Diseases

- Food borne diseases are still a major public health concern all over the world today. They are responsible for many cases of adult illnesses and some deaths, but more importantly, contaminated food is a source of the acute diarrheal diseases that claim the lives of enormous numbers of children every day. Worldwide, about 2 million children under the age of five years die from diarrheal diseases every year.
- In developing countries like Ethiopia, the problem reaches great proportions for many reasons. Most basic among these are poverty and a lack of public health awareness. The problem of food borne disease is more serious among rural communities where there tends to be a lower level of awareness about the causes and prevention of food borne infection.
- Well-documented information is lacking regarding the extent of food borne diseases in Ethiopia because many cases are not properly diagnosed or not reported, and many people who are sick with food borne diseases do not visit health facilities.

- **Sources of Food Borne Diseases**

1) From raw foods: TB, brucellosis, staphylococcal and streptococcal infections from milk, beef tape worm from cattle raw meat, brucellosis from sick sheep; amoebiasis and giardiasis from raw vegetables;
2) From the environment: flied, rats, contaminated water and equipments;
3) from food handlers: skin lesions, spitting, coughing,
4) From sick animals: salmonellosis, brucellosis, streptococcal infections, staphylococcal infections, TB, tec.

4.2.1. Classification of Food Borne Diseases

- Food borne diseases are usually classified based on their causes. Accordingly, they are divided into two broad categories: food poisoning and food infections. Each of these categories is further subdivided based on different types of causative agent.

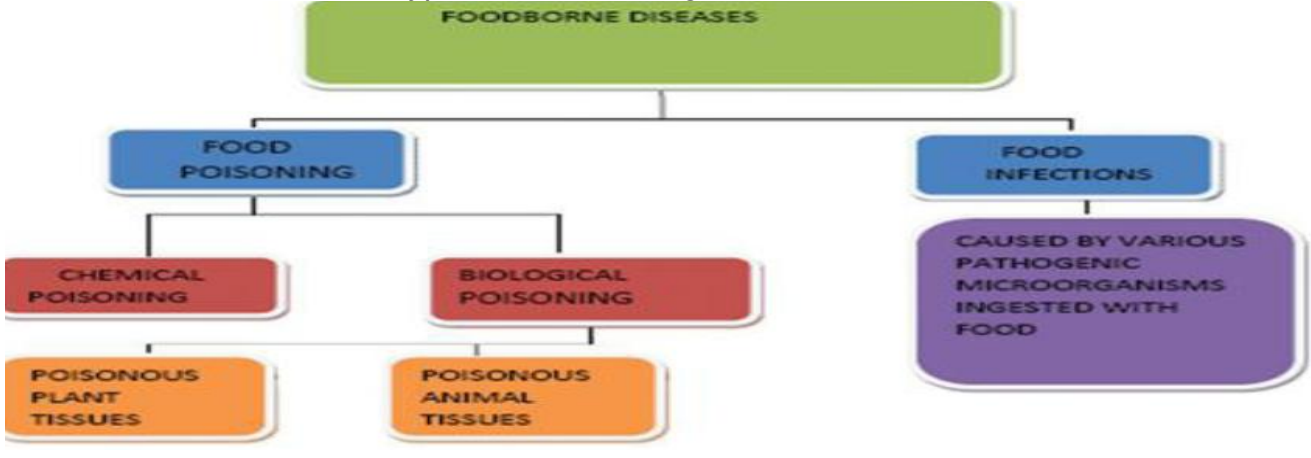

Figure 2.1: Classification of food borne diseases.

1. Food Infection

- It is a condition in which pathogenic enteric microorganisms enters the GI tract with contaminated food, multiplies, and attacks intestinal tissue, causing illness or infection.
- **Causative agent**: virus, bacteria, protozoa, and helminthes. Example: Infectious Hepatitis A; poliomyelitis; typhoid fever, shigellosis; amoebiasis, giardiasis; taniasis; ascariasis, etc., most live in soil, water, and animals.
- **Incubation period:** varies from a day to few weeks: 1-3 days for shigellosis and 4-12 weeks for taniasis in man. Grows well at body temperature (20-370C) and they are aerobic.

- **Common symptoms: -** usually depends on dose and host resistance; however, the common manifestations of infections are fever, bloody diarrhea, abdominal cramp, loss of appetite, weakness and the likes.

- **Mode of transmission**: Faeco-oral (5 Fs)
  - The Common methods of prevention and control of food infection is Control measures that targeted at the source of infection, at the environment and at the susceptible host.

2 Food Poisoning

- A condition in which a chemical agent, or a poisonous plant, or animal or bacterial **toxin** present in food before it is eaten causes intoxication when it is consumed.

- **The common ones are toxin-producing fungus**.

a) Chemical food poisoning:

- Intentionally and unintentionally induced heavy metals (lead, antimony, zinc, copper, and mercury), pesticides, insecticides, rodenticide, herbicides, fertilizers and the likes.
- Incubation period is usually less than one hour.
- Vomiting, diarrhea, and intoxication are common symptoms. Contamination in the crop field; accidental poisoning, from cooking metal containers; unauthorized use of additives; use of unclean sacks or contains used for chemical storage; migration of metals from metal containers to food in acidic condition.

b) Poisonous plant tissues and animal tissues:

- The usual media for intoxication is cereal grain such as wheat, barley, rice): fungus (from seeds of groundnuts and other seeds. Poisonous mushrooms and non-edible fishes are the common cause of food poisonous.

- **Microbial intoxication:**
  - Botulism (clostridium botulism), Cl. Perffringens, staphylococcal aurous are the common microbial intoxication of food poisoning.
  - The agent exotoxin produced in food before ingestion, the toxin and spore are heat resistant and forms enterotoxin at room temperature (18-25C0)
  - **Incubation period:** from one hour to 24 hours or 2-4 hrs for staphylococcus and 2-36 hrs for botulism.
  - **Source of infection:** canned food (fish, meat, edible fungus) for botulism and milk and its products, creamy cakes, infected person/food handler for staphylococcus poisoning.
  - **Clinical symptoms:** explosive onset, acute gastro-enteritis: vomiting, abdominal pain, watery diarrhea, nausea, headache and the like.
  - **Mode of infection:** spore and vegetative forms of bacteria in the course of growing at favorable environment (pH, moisture, and room temperature) produces enterotoxins and the contaminated (intoxicated) food is eaten.

❖ **Control measures of food poisoning:**

a. Sterilization of canned foods; boiling and cooking of suspected food for long duration;
b. Prevention contamination from animals and soil;
c. Pasteurization of milk;
d. Personal hygiene;
e. Food handler's health;
f. Animals health;
g. pH and moisture control; food storage temperature control;

4.2.2. Management of Food Born Diseases

- The management approach to patients with food borne diseases depends on the identification of the specific causative agent, whether microbial, chemical or other.
- There are many different kinds of food borne diseases and they may require different treatments, depending on the symptoms they cause.
- Many episodes of acute diarrheal disease are self-limiting and require only fluid replacement and supportive care.
- If an antibiotic is required, the choice should be based on the clinical symptoms and signs. Patients with severe diarrhea and vomiting may need oral rehydration salts (ORS) and antibiotics.
- In the most severe cases, for example in a cholera epidemic, intravenous fluids may have to be given containing glucose and normal saline to support rehydration.
- If the disease is due to food poisoning, there may be a need to give an antitoxin, or other antidote to neutralize the effect of the toxin, if such medicines exist or can be accessed in time.
- These more specialized interventions can only be done at a health facility. However, the limitations of health facilities in rural areas may restrict the choice of the specific management approach.
- As a Health Extension service provider, you should educate the members of your community on how to recognize the symptoms of food borne diseases, and to seek advice and supportive treatment from you.
- If there are a large number of cases, you should document them and report them as soon as possible to the District Health Office.

Self check #2	**Written test**

Direction:- Choose the correct answer from the given alternatives

1) Sources of Food Borne Diseases
   A. Raw food B. Environment C. Food handlers D. All

2) It is a condition in which pathogenic enteric microorganisms enters the GI tract with contaminated food and causing infection
   A. Food infection B. Food poisoning C. Chemical poisoning D. None

Note: Satisfactory rating 2 points unsatisfactory below 2 points

You can ask you teacher for the copy of the correct answers

Answer Sheet

Score _____

Rating _____

Name: _____ Date: _____

Information sheet #3	Promoting Food Protection and Preservation

4.3 Food Protection and Preservation Methods

4.3.1 Food Protection, Storage and Preparation

- Food protection
  - Food protection methods are measures taken to protect food from being contaminated by any agent.

❖ **All food must be protected at all times during storage and preparation from the following contaminants**:

- ✓ any water that is not known to be safe, including overhead leaks and drips
- ✓ dirty hands
- ✓ coughing and sneezing
- ✓ dust and soot
- ✓ flies, rodents and other vermin
- ✓ insecticides and other chemicals
- ✓ unclean utensils and work surfaces
- ✓ Cigarette smoke.
- ✓ coughs and sneezes
- ✓ Insects.

- The most important way of preventing contamination is by adopting good food handlers' hygiene. This is the term for a group of practices that should be followed at all times by anyone handling food at any stage of the food supply process.
- Food handlers' hygiene in retail and commercial premises where food and drink is sold to customers is of critical importance.

❖ The importance of promoting good food handlers' hygiene:-

- To prevent food contamination and spread of disease.
- To ensure the good health of people eating the food.
- To protect the health of the food handler.
- Anyone handling food should avoid bad habits such as scratching, touching the hair, nose or mouth, having unclean hair, unclean and long fingernails, smoking and coughing or sneezing in food handling and preparation areas.
- Always wash their hands before starting to prepare food, and after every interruption, particularly after using the toilet. People who have skin infections, diarrhoea or sore throats should avoid handling food.

❖ There are other general principles for preventing food contamination:

- All water used in food preparation should be wholesome.
- All dishes, glasses and utensils must be kept clean by regular washing in clean water, clean utensils and should be kept covered.
- All surfaces that come into contact with food should be meticulously clean
- Food storage, preparation and serving areas should be free of pets, rats, mice and insects.
- Food should be covered, and kept separate from chemicals and poisons.
- Cloths that come into contact with dishes and utensils, and that are used to cover food, need to be changed daily and boiled before use.

❖ **Precautions for food storage**

- One critical aspect of food protection is appropriate food storage. Food storage areas should be well ventilated and illuminated, and protected from overhead drips.
- Floors, wall surfaces and tables should be easy to clean, and the floors should be well drained.

❖ **The storage area should be kept free from insects and vermin, by screening if possible.**

- Food should be obtained from approved sources and should come in its original container. It should be kept free from contamination once it has been received from the supplier.

- Processed foods are often safer than unprocessed, for example, pasteurized milk is safer than raw, untreated milk. Whether in the home or in commercial premises, once in the food preparation area, food should be kept on shelves or clean racks.
- These should be sufficiently high off the floor, at least 50 cm, and be spacious enough to prevent contact spoilage or contamination.
- This is especially important for storing raw and cooked foods, which must never touch each other, because raw food can contaminate the cooked food.
- Perishable and potentially hazardous foods that can be easily contaminated, such as milk and raw meat, should be stored at low temperature, preferably in a refrigerator at below 10oC. Frozen foods should be stored in a freezer below -18oC.
- The general rule for food storage is to keep hot foods hot and cold foods cold. Cooked foods should be eaten immediately, but if there is a delay the foods should be kept at a temperature higher than 60oC.
- Allowing cooked food to cool to room temperature allows microorganisms to start to grow and multiply therefore cooked food must be stored very carefully.
- If it cannot be eaten straight away, it should be kept as cold as possible, ideally in a refrigerator, to avoid growth of microorganisms.
- If food does have to be reheated, this must be done thoroughly. If food is only warmed and not reheated properly, microorganisms will multiply in it, so you need to heat it enough to destroy them. Infant foods should not be stored at all, but must be used immediately.

Figure 3.1:- Vegetables must be clean before cooking.

❖ **Precautions for food preparation**

- Food is particularly vulnerable to contamination while it is being prepared for eating. It is important to remember food handlers' hygiene and to ensure that all surfaces and utensils are clean.
- Foods intended to be eaten raw, such as fruit and some vegetables, must be washed carefully in clean, safe water.
- Food that is to be cooked must be cooked thoroughly to kill all pathogenic microorganisms. All parts of the food must reach a temperature of at least 70oC.
- You cannot tell how hot the food is just by looking, so it is important to cook the food for long enough to make sure that it is all cooked through.
- Cooking, as well as being a very important part of food preparation, is also used for preserving food and this is the subject of the next section.

Figure 3.2:- Food preparation surfaces and equipment should be kept very clean to avoid contamination.

4.3.2 Food Preservation

- Food preservation includes a variety of techniques that allow food to be kept for extended period of time without losing nutritional quality and avoiding the growth of unwanted microorganisms

- **There are three basic objectives for the preservation of foods:**
  - ✓ Prevention of contamination of food from damaging agents
  - ✓ Delay or prevention of growth of microorganisms in the food
  - ✓ Delay of enzymatic spoilage i.e. self-decomposition of the food by naturally occurring enzymes within it.

- For storing or preserving food, one or several of the living conditions needed for the growth of microorganisms have to be removed. Like humans, microorganisms need a source of food and water and they need a suitable pH and temperature to grow, so food preservation techniques aim to target these requirements.
- Food preservation depends on procedures which effectively manage the microbial content of foods and on processes that alter or delay the activities of enzymes in the food.
- The techniques may be applied separately or in combination. Their aims are to prevent contamination in the first place, to remove or reduce the numbers of contaminants, and to prevent microbial growth. We describe them below.

1. Dehydration by using of high temperature:-

a. Drying by sunlight: vegetables, cereals (traditional method)
b. Process heating (milk powder)
c. Smoking (fish, meat, cereals (bikil)

2. **Dehydration by chemicals**:

a) Salting in 18% brine solution (fish, meat)
b) Mixing or rubbing with a dry solid salt (butter, meat)
c) Dehydration by 65% sugar solution (fruits)
d) Pickling in concentrated natural acid solutions like vinegar(vegetables)

3. Use of temperature methods:

1 .pasteurization

- Is the killing of pathogenic microorganisms and spoilage microbes without appreciably destroying the useful flora and enzymes of milk.
  a) The methods are the holding (batch or vat) method: at 63C0/30 min contact time
  b) High temperature short time (HTST) or flash method: 720C/15 seconds
  c) Ultra high temperature (UHT 88): one second. All methods are followed by immediate cooling at<100C.

2 .Sterilization

- The killing of all pathogenic and non-pathogenic microbes by using very high temperature: about 120-1320C such food can be stored at room temperature for long period within the shelf life. Food canning is an example of Sterilization.

4. Use of low temperature:

- Refrigeration at 0-7.2C0 (32-450F)
- Best at 0-4.40C (32-400F)
- Freezing <00C
- Deep freezing <-180C

5. Use of pH regulation:

- Transformation of food into an acidic state: injera and bread baking, milk products (cheese), pickling (use of vinegar) and the likes. Most bacteria will not grow in pH<4.5
- Some other methods of food preservation are also used in the food industry.

Self check # 3	**Written test**

Direction:- Say “True” or “False”

1) The most important way of preventing contamination is by adopting good food handlers’ hygiene.
2) Pasteurization The killing of all pathogenic and non-pathogenic microbes by using very high temperature

Note: Satisfactory rating 2 points unsatisfactory below 2 points

You can ask you teacher for the copy of the correct answers

Answer Sheet

Score _____

Rating _____

Name: _____ Date: _____

Short Answer Question

1._____

2._____

Information sheet #4	Educating Hygienic requirements of Food and Drink Establishments

4.4 Hygienic requirements of Food and Drink Establishments

4.4.1 Definition of terms

- Food and drink establishments are places where an individual gets food in the form of breakfast, lunch, dinner or snacks, accompanied by some form of drink.
- The commonly served food in these establishments are foods of animal origin which are perishable foodstuffs, and need special attention during processing, preparation, transportation and storage to avoid them becoming contaminated and causing ill health to the consumer.
- Unhygienic practices in food and drink establishments affect the health of the clients.

4.4.2 Categories of Food and Drink Establishments

- Food and drink establishments provide food and drink services to a relatively large number of users in the form of breakfast, lunch, dinner or beverages.
- Food and drink establishments have a responsibility to provide safe food and drink to the consumers.
- The consumers have the right to demand safe food. Unless food is prepared and handled in hygienic conditions, it spreads food borne disease that could affect a large number of people at a time.
- The local government (kebele) takes actions to ensure the hygienic functioning of these establishments.
- The Ethiopian Regional and National hygiene and environmental health regulations can be exercised in the kebele by the presence of an appropriate expert who is authorized to enforce them.
- As a Health Extension Service provider, you can make a link with this authority through regular reporting to ensure that the necessary actions are taken to maintain safe practice.

❖ **There are several types of food and drink establishment in rural areas:-**

1) **Restaurants**: are food establishments that provide lunch and dinner (Figure 8.1) with accompanying drinks.
2) **Cafés or Tea houses**: provide hot drinks and snacks. Hot drinks include tea, coffee, milk, and macchiato. Snacks include Cakes, bread, bombolino, chornake and sambusa.
3) A local drinking establishment that offers a local light alcoholic beverage and common in rural areas of Ethiopia are includes **Tej bet, Tela bet,** Areki bet and the likes
4) **Grocery**: is an establishment that provides packed food, drink items and hot dishes
5) **Butchers shop**:- is a food establishment that offers meat for sale.
6) **Bakery**: is a food establishment that offers bread for sale.
7) **Hotel**: is a food establishment that offers all types of food and drinks in addition to bed room services.

Figure 4.1: A typical lunch served in an Ethiopian restaurant. **Figure 4.2**: A butcher's shop

4.4.3 Hygienic requirements of Food and Drink Establishments

1 Licensing

- The system for licensing food and drink establishments in kebeles. The woreda health office is responsible for this licensing system.
- As the local Health Extension Practitioner, you may be requested to do a preliminary assessment to check the hygienic requirements and report to the woreda health office
- Most categories of food and drink establishments can be licensed, though tela- bet and areki- bet do not require it because of their lower level of health hazards.
- The licensing procedure must follow regional and local regulations.

2 Locations of the Food Establishments

- Food establishments need to be well away from any source of hazards such as marshy areas, waste disposal sites and flooding.
- The site must be conveniently accessible to staff and consumers.
- The establishments should be at a distance from public institutes such as schools and health facilities. Access to clean air and natural lighting is also important.

3 Condition of the Building

- The space available must be adequate to provide the kind of service that the establishment carry out. Depending on the nature of the establishment, the space may include kitchen, dining room, drinking room, food storage sites, and utensil washing site.
- Building structures and their interiors should permit good hygienic practices, including protection against cross-contamination of food surfaces between and during operations.
- The provision of a window for each room should ensure adequate lighting. Structures within processing establishments should be soundly built of durable materials and be easy to maintain, clean and, where appropriate, disinfect. Floor and wall surfaces must be cleanable and washable.
- The surface of the walls must have a light color that maximizes the interior lighting. The roof must be cleanable and maintained free of dirt.

A. Dining rooms and coffee or tea drinking rooms

- The dining room should be very attractive in terms of its cleanliness, lighting and natural ventilation. The cleanliness of the walls, floor and ceiling must be acceptable and the chairs and tables must be in good repair. Leftover food must not be dropped on the floor but should be collected and disposed of in a garbage container.

B. Hotel bedrooms

- The cleanliness of the bedding (sheets, blanket, hard surfaces) and the cleanliness of floor, walls and ceiling are important. A chair and table are also useful for the client's comfort. A small waste bin must be available. Good ventilation and lighting are also essential components of a hygienic bedroom.

4 Sanitary Facilities

- Food and drink establishments need to offer sanitary facilities, which means hand washing facilities, latrines and urinals, proper solid and liquid waste management and washing detergents.
- The hand washing facility must have soap; a liquid soap is appropriate if this is available. Separate latrines for men and women are desirable.
- The number of these facilities depends on the number of clients visiting at peak hours. Generally, one hand washing facility and latrine for 30 clients per day is appropriate. Food handlers should be provided with a separate latrine, hand washing and changing wearing facilities at a convenient location. The availability of soap is essential for proper hand washing.

Figure 4.3: Soap is essential for proper hand washing

5 Accesses to Water

- Food and drink establishments require a sustained source of safe water to be used for personal hygiene, food preparation and utensil cleaning. A water tank is one option to ensure the availability of water at all times.

6 .Waste Management

- Food and drink establishments produce organic wastes such as food remains, and liquid wastes as a result of hand and kitchenware washing. These wastes need to be handled properly without contaminating or polluting the immediate environment. Specific information on waste management can be found in the study sessions later in this module.

7 Kitchens and Food Preparation Site

- The space and layout of the kitchen must be appropriate to accommodate the food preparation and kitchen processes. There must be separate sections for raw food preparation and handling cooked food.
- The presence of a window and a chimney is essential in order to manage the indoor air pollution that is caused by biomass fuel burning. The presence of facilities for washing hands and kitchenware is mandatory in a kitchen.
- Proper shelves for physically separating soiled and cleaned items are also a necessity. Food scraps and leftovers must be placed in a covered container. The floor and tables need to be cleaned frequently during the processes of food preparation and cooking.

8 Cleaning Dishes, Drinking utensils and Cutlery

- The cleaning of soiled dishes is an important way of preventing communicable diseases. The person who is the dishwasher must follow an established procedure.
- Dish ‘in this section includes plates, cups, glasses, spoons, forks and other utensils.

A. **The three bowl method for cleaning soiled dishes**

- The manual cleaning process requires three vats or bowls, each with a capacity of 20–30 liters .Washing equipment such as detergent (powdered soap) and a scraping cloth, sponge or cleaning brushes are also necessary.

Figure 4.4:- Dish cleaning guidelines where there is no running water

B. Washing cups, glasses and spoons

- The principle of cup washing is the same as that of washing soiled dishes. The three bowl system should be encouraged but twobowls is also acceptable, with warm water and detergent in the first bowl and hot water in the second. The first wash cleanses the grease, while the second bowl sanities the cups. Cups must be dried with a clean piece of cloth or air-dried before use.
- The glass-washing facilities for birle in tej bet should use a three-bowl system. The first is used for washing with detergent, the second and third for rinsing. When cold and hot running tap water is available, sinks with two compartments/bowls are sufficient because the hot running water is used for rinsing and sanitizing

C. Washing cups, glasses and spoons

- The principle of cup washing is the same as that of washing soiled dishes.
- The three bowl system should be encouraged but two bowls is also acceptable, with warm water and detergent in the first bowl and hot water in the second.
- The first wash cleanses the grease, while the second bowl sanities the cups. Cups must be dried with a clean piece of cloth or air-dried before use.
- The glass-washing facilities for birle in tej bet should use a three-bowl system.
- The first is used for washing with detergent, the second and third for rinsing. When cold and hot running tap water is available, sinks with two compartments/bowls are sufficient because the hot running water is used for rinsing and sanitizing.

Figure 4.5: Washing glasses in a sink) with detergents, and cold and hot tap water.

9 Maintaining Hygienic Kitchen Equipment

- All surfaces that come into contact with food should be constructed of appropriate materials and are well-maintained.
- For example, wooden boards must be smooth and metal tables should be plain and not corrugated. Any surface that is cracked, scored or has an irregular surface is difficult to clean and may harbor dirt. Chopping and cutting blocks for preparing meat or vegetables must be kept clean and covered.
- All utensils and equipment must be protected from possible contaminants including dust, dirt, insects, rodents and overhead drips.
- Equipment and food containers should be made of materials with no toxic effect and be designed to ensure that they can be easily cleaned, sanitized and maintained.
- Surfaces such as chairs and tables that do not normally come into contact with food should also be clean and in good repair. Always use clean clothes to cover tables and change them whenever necessary.

10 Storing and Serving Foods

- Perishable food items are easily spoiled if stored at room temperature. Foods such as meat should be kept in a refrigerator that can keep the temperature below 10°C.
- Semi-perishable foods, such as potatoes and carrots, which are used on a daily basis, need to be stored on a well ventilated shelf.
- The serving of foods to clients should provide maximum health protection. Hot foods should be served while they are hot, and cold foods while they are cold
- Foods must be thoroughly reheated if they have been at room temperature for longer than 1 hour.

11 Vector control in the premises of food and drink catering establishments

- Vector management is a challenging task in food establishments. What vectors are you likely to find in kitchens and food storage areas of food and drink establishments? Flies, cockroaches and rats are commonly observed in these places.

4.4.4. Food Handlers Health and Hygiene

- The practice of good personal hygiene that you learned about in the previous session is essential for anyone who handles food, especially in food and drink establishments where many customers could potentially be affected.
- A sick food handler with symptoms of diarrhoea, eye and ear discharges, skin infections, open cuts and wounds, or coughing should not continue working.
- They must be treated and be completely recovered before returning to work.
- What are the main principles of food handlers'hygiene?
- To protect food from contamination and to protect the health of the consumers.
- Food handlers must use personal protective devices such as clean aprons, overalls or gowns, footwear and hair cover.
- As a Health Extension Service provider, you should be involved in training food handlers on food safety. The strict rules of hand washing after using the latrine or touching dirt and before handling food must be followed.
- Indicates some bad habits of food handlers that should be avoided.

- **Unhygienic practices by food handlers**
  - ✓ Poor personal hygiene practice
  - ✓ Unguarded coughing or sneezing
  - ✓ The habit of licking the fingers
  - ✓ Nose picking or fingering the nose
  - ✓ Handling of handkerchiefs
  - ✓ Working in street clothing

- ✓ Spitting in food-handling areas
- ✓ Uncovered hair
- ✓ Smoking in kitchens
- ✓ Ignoring hand washing before starting work, after handling contaminated materials, after breaks and after using toilet facilities

4.4.5 Sanitary Inspection in Food and Drink Establishments

- ➢ Health Extension Service Providers have the responsibility of safeguarding the health of the public by ensuring safe hygienic practice in food and drink establishments.
- ➢ Inspecting the food Establishments, (sanitary inspection) is a means of identifying or monitoring unsafe practices of food handling.

1. Purpose of the Inspection

- ➢ Sanitary inspection is a set of activities concerned with the preservation of public health and the investigation of environmental hazards in food establishments.

▪ Sanitary inspection aims to investigate and detect:

- ✓ Food spoilage and its sources
- ✓ Food contamination and its sources
- ✓ Provision for hygienic procedures (dish and hand washing, food storage)
- ✓ Provision of sanitary facilities (latrine, water, shower, hand washing)
- ✓ The proper location of the establishment
- ✓ The hygienic practice of food handlers
- ✓ Proper waste management (storage, collection and disposal)
- ✓ The presence of vectors

▪ Sanitary inspections are carried out for two reasons: first:-

- ✓ To provide education and advice to the owners.
- ✓ Second, for providing a license if you are asked to do so in the absence of the woreda environmental health worker.

2 When to Inspect

- ➢ There must be a baseline survey of food and drink establishments using a survey checklist. Appendix 8.1 (at the end of this study session) is an example of the sort of surveillance form you could use for your survey.
- ➢ The survey result must enable you to classify the food establishments by hygienic status and to set priorities for inspection. You do not have to inspect tela bet and areki bet, as noted above, because of their lower hazard level.
- ➢ Each food establishment should be inspected at least once every year. However, since the number of food and drink establishments in the kebele setting is probably low, often less than ten, then inspecting each four times a year should be possible.

3 Informing the owners about the Sanitary Inspection

- ➢ It is always useful to warn the owners about your inspection visit, including the date, time and purpose. This is useful as your job is promoting food safety and hygienic practice, and your warning may encourage them to check and improve their practices.
- ➢ The kindness and help you get from the owner will facilitate your decisions about the appropriate hygienic instructions to give.

4 How and what to Inspect

- ➢ Upon arrival at a food and drink establishment, you should introduce yourself and announce politely the purpose of your inspection in order not to embarrass the owner.
- ➢ Interviewing food handlers, physical observation and the use of a checklist are the main tools for data collection. Information is also collected by interviewing the owner and the food handlers.

- The inspection starts by checking the physical presence of latrines and hand washing facilities meant for the clients.
- The inspection is based on the food preparation flowchart and is carried out in a sequential manner: food storage, kitchen, dining room and drinking rooms.
- The handling of raw food is inspected in the food storage room.
- The use of refrigerators for perishable food items (meat, eggs, juice, fruits and vegetables) is checked. Semi-perishable foods such as potatoes and onions need to be stored on shelves that are properly ventilated and free from any vectors.
- In the kitchen the use of detergents, the presence of three dishwashing bowls (or a sink with running water) and the practice of personal hygiene must be closely checked.
- There should be no vectors such as flies and cockroaches in the kitchen area. The food handler‘s health is rapidly checked by doing a physical examination for the presence of active infections (skin, eye, ear infections or nasal discharges).
- The proper use of apron, gown or overalls, hair cover and appropriate footwear by the food handler is also investigated.
- The strict separation of kitchen tables for cooked food items and raw food needs to be inspected. The presence of obvious indoor air pollution is also important to note.
- In the dining room, the condition and cleanliness of the tables, chairs, floor, walls, and ceiling should be observed. The presence of vectors and proper waste management facilities must be inspected in all parts of the food processing and serving areas.
- The proper handling of kitchen waste in a garbage container, and the presence of a waste bin in dining areas should be checked. As you make your inspection, record the information on the checklist.

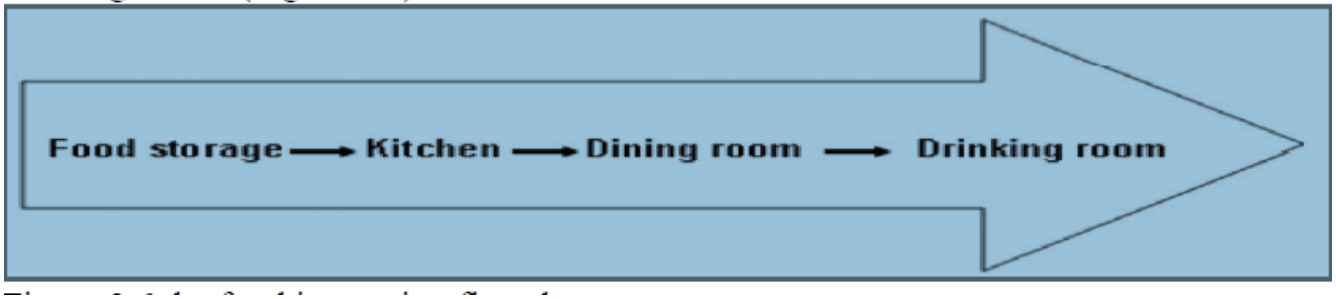

Figure 4.6:- the food inspection flowchart.

5. **Concluding the Sanitary Inspection**
   - Discuss your findings with the owner, and explain what hazards and unacceptable hygienic practice you have found. Please also point out what is good.
   - Explain clearly your suggestions for improvement and the urgency of the timescale. It is important that you educate and persuade the owner to implement your advice.
   - Tell the owner that you may revisit the food establishment in future to check what has been improved. You need to keep all the inspection reports for future reference and you should report to the kebele and woreda offices if improvement is not achieved after repeated efforts.

Self check #4	Written test

Direction:- Choose the correct answer from the given alternatives

1) Food establishment that offers meat for sale.

A) Restaurants **B)** Grocery **C)** Butcher's shop **D)** Bakery

2) All are Unhygienic practices by food handlers' **except**.

A) Poor personal hygiene practice **B)** Proper hand washing **C)** Unguarded coughing. **D)** None

3) Sanitary inspection aims to detect

A) Food spoilage **B)** Food contamination **C)** Provision of sanitary facilities **D)** All

Note: Satisfactory rating 3 points unsatisfactory below 3 points

You can ask you teacher for the copy of the correct answers

Answer Sheet

Score _____

Rating _____

Name: _____ Date: _____

Short Answer Question

1._____

2._____

3._____

Information sheet # 5	Identifying Hygiene and safety requirements for food of Animal Origin

4.5 Hygiene and safety requirements for food of Animal Origin

4.5.1 Meat hygiene

- Diseases transferred to humans from animals are known as zoonotic diseases.
- One route of transmission of zoonotic diseases is by the consumption of infected meat.

- **The most common zoonotic diseases found in Ethiopia are:**
  - ✓ Bovine tuberculosis
  - ✓ Anthrax
  - ✓ Salmonellosis
  - ✓ Hydatid disease
  - ✓ Trichinosis
  - ✓ Toxoplasmosis
  - ✓ Taenia saginata, beef tapeworm (kosso)
  - ✓ Taenia solium or pork tapeworm infection
  - ✓ Diphyllobothriasis, fish tapeworm
- **Abattoirs and meat transportation**
  - Abattoirs, also known as slaughterhouses, are establishments where livestock are killed prior to human consumption.
  - Slaughterhouses should be subject to inspection to ensure that the meat they produce is safe to eat. This includes inspection of live animals and of the slaughtered animal carcasses.
  - Before slaughter, the animals should be observed to check for any abnormalities in their appearance or behavior that could indicate sickness.
  - After slaughter, a qualified meat inspector who knows the signs of specific types of disease and in which organs they may be found should inspect animal carcasses.
  - If the carcass passes the inspection, it will be stamped with safe, indelible ink to indicate it has been approved for human consumption.
  - The carcass should be transported soon after slaughter, in a special vehicle, to a butchery or distribution centre. If such customized vehicles are not available, every precaution should be taken to avoid contamination of the meat during transport. Even if the meat travels in a wheelbarrow it should be kept absolutely clean.
- **Hygiene in the butchers shop**
  - Butcher‘s shops are the link between the inspected and approved safe meat, and meat products and the consumer. Therefore, the hygienic practices used for handling meat in these shops determine the health of the meat consumer.
  - The butcher‘s shops need licenses to operate, confirming that they meet all the handling specifications that ensure the safety of the meat.
  - The walls and floor should be constructed of durable material and be smooth, impermeable, easily cleanable and light-colored. There should be adequate ventilation and natural light.
  - The utensils should be clean and kept in an appropriate place.
  - The butcher should wear a clean white gown, preferably with an apron and a white hair cover.
- **Meat preservation methods**
  - Meat is highly perishable, so it must be preserved properly. One way of doing this is to chill the meat in a refrigerator.
  - Temperatures for refrigeration of meat should be lower than the usually recommended 10oC and should be below 7oC for carcasses and below 3oC for offal.
  - For long-term storage, meat should be frozen. However, since most rural people do not have a refrigerator or freezer, they should use traditional preserving methods.

Figure 5.1:- the butcher wears a clean, white gown.

- **Your role in controlling tapeworm infection**
  - Ethiopia is a country with a lot of raw meat consumption and a high prevalence of tapeworm. Two rules must be enforced, and educating the community about them is an essential part of your role.
  - No one should offer any food for eating that is unsafe or unfit for human consumption.
  - Meat for sale not bearing the stamp of approval of the public municipal slaughterhouse should be considered unsafe for human consumption.
  - Additionally there are measures that you can recommend in the community. Abstaining from eating raw or inadequately cooked meat is a good control measure.
  - The Ethiopian dish of kitfo or lebleb kitfoll is not safe to eat. However, there are strong cultural reasons for this practice, so people may not take your advice.
  - The best control measure against meat -borne diseases (zoonosis) is to cook the meat thoroughly before consumption. Exposing meat to a temperature above 56oC inactivates any cysticercus bovis (beef tapeworm cysts) present.
  - Organized and strict meat inspection practices in abattoirs can ensure that meat is free from tapeworm infection as well as other meat borne diseases.
  - Finally, avoiding open defecation is a major control measure for zoonotic and other faeco-oral diseases.

4.3.2 Milk Hygiene

- **The provision of a safe supply of milk is of great importance for public health, with the following objectives:**
  - The improvement of nutritional status of infants, children, and mothers
  - The prevention of disease or physical defects arising from malnutrition
  - The prevention of communicable, zoonotic disease transmission
  - The control of milk adulteration.
- **Sources of Milk- Borne Diseases**
  - Disease organisms in milk are derived from the dairy animal itself, the human handler, or the milk-handling environment.
  - What human behaviors might result in milk contamination?
  - Poor personal hygiene by the food handler including activities such as coughing, sneezing or scratching over the milk, and allowing objects, particularly fingers, to come into contact with the milk.
  - In terms of the environment, the milking and milk-handling processes must be carried out hygienically, avoiding contamination with soil, manure, animal hair or dirt from the cowshed.
  - The milk containers must be clean and disinfected. Bovine tuberculosis, Brucellosis, Q (query) fever Anthrax are the common diseases that may be transmitted from milks of cows.

- **The need of Milk Hygiene**
  - Milk sanitation i.e. the protection of milk from dirt and contamination is essential to prevent milk infection.
  - Boiling, Sterilization, Drying, and Pasteurization are the common methods of making milk safe. Clean milk is a necessity, and is possible by using good milking hygiene.
- **Hygienic milk production**
  - Animals must be clean and healthy
  - Milking should be done away from the herd
  - The milk handler should also be clean and healthy
  - S/he should wear clean outer garments during milking or processing the milk
  - The milking room should be clean, ventilated and dustless
  - Utensils and equipment for milking and milk handling must be clean
  - Immediately before milking the udder and teats of the cow must be washed with clean lukewarm water and dried with clean cloths a separate one for each cow.
  - Immediately after milking, the milk must be removed from the shed, placed in a clean and covered receptacle and kept in a cool place

Figure 5.2:- milking a clean and healthy cow

4.5.3. Poultry and Egg hygiene

- Poultry consumption has greatly increased in recent years .
- Due to poor hygiene, poultry and poultry products are responsible for a number of food borne illnesses including salmonellosis, staphylococcal food poisoning and botulism.
- Less common diseases include psittacosis or ornithosis,n also known as parrot fever, which is a zoonotic disease caused by the bacterium Chlamydophila psittaci, and ‘bird flu’ which is a viral disease that can affect both poultry and people.

Figure 5.3:-Healthy; well kept poultry are good sources of protein from eggs and meat.

- **Poultry keeping and processing**
  - Correct sanitation procedures involve all stages in the operation from live poultry pens to retail establishments, including processing, packing, storage and transportation.
  - Whether in large-scale commercial production, or domestic poultry keeping, the poultry handlers must be healthy and maintain food handlers' hygienic practices. In the poultry farm, the housing, feed and water supply must be safe. The plant and equipment must be cleaned daily.
  - In particular, any dead birds must be removed from coops. During processing, hygienic methods of killing and dressing must be used.
- **Handling eggs**
  - Although most freshly laid eggs are sterile inside, the shells soon become contaminated by faecal matter from the hen and the lining of the nest. When collecting eggs, any visible dirt should be rubbed off the shells. During handling, contamination can also arise from washing water and from any packing material. However, some eggs will be spoiled on the inside, generally because of cracks in the eggshell through which bacteria can enter.

Figure 5.4:- These eggs are clean and have no cracks.

- **It is important to test for egg spoilage, and this can be done in the following ways.**

1. Inspection

- Eggs should first be inspected for cracks, leaks, stains or dirt on the exterior and general bloodiness or translucent spots in the yolk when candled (see below). You are looking for freshness, soundness, size and cleanliness of the shell.

2. Shaking

- A fresh egg makes no sound, but a stale (bad) egg makes a sound when shaken.

3. Candling

- This is performed by holding the egg between the eye and a light such as a candle flame or the sun. As the shell is translucent, you can assess the internal quality and the size of the yolk.

4. Floating

- Fresh eggs usually sink to the bottom of a bowl of water, whereas spoiled eggs float and can be removed. Floating occurs because, in spoiled eggs, the air cavity is bigger, which makes the egg more buoyant.
- The problem with this method is that the water may penetrate through the eggshell pores so it is important to use clean water, change it frequently and not to leave eggs in the water.

5. Breaking

- In this test, around 10 eggs out of 100 are taken randomly and checked for spoilage by breaking them open to see what is inside. This is the most accurate testing method but it is not cost effective, so is only used when the other methods are not exercised, for example in large-scale operations.

6. Storing eggs

- Since eggs are perishable food items they need proper storage. They should be kept cool and dry.
- Maintenance of the egg's internal quality depends on the time and conditions of storage, especially the temperature and the presence of tainting substances in the storage environment.
- Eggshells are porous and eggs can quickly absorb foreign odours which will taint the contents.
- It is therefore advisable to avoid storing strong-smelling and volatile materials such as kerosene or varnish near egg stores.

Self sheet # 5	Written test

Direction: - Choose the correct answer from the given alternatives

1) Methods of making milk safe.

A) Boiling **B)** Sterilization **C)** Pasteurization **D)** All

2) All are zoonotic diseases **except**

A) Bovine tuberculosis **B)** Cholera **C)** Toxoplasmosis **D)** Anthrax

Note: Satisfactory rating 3 points unsatisfactory below 3 points

You can ask you teacher for the copy of the correct answers

Answer Sheet

Score _____

Rating _____

Name: _____ Date: _____

Short Answer Question

1._____

2._____

Operation Sheet #1	Performing Dish washing

Steps for Dish washing

1. Decide what to wash first: generally it is best to start with glasses and cups. However, the following description is for washing soiled plates.
2. Fill the first two bowls halfway with warm water (50°C). Hot water (80°C or above) is added to the third bowl. A detergent must be included in the first bowl.
3. Scrape the food from dish surfaces and collect it in a garbage container. Place the dish in the first bowl and wash with the detergent until the grease has gone. Washing plate by plate increases cleaning efficiency. Then place the washed item into the second bowl.
4. Rinse the dish well in the second bowl. Any remaining food particles and soap must be taken away by thorough rinsing. Then place the dish into the third bowl.
5. The process of dish washing in the third bowl is called sanitizing which is a procedure to inactivate and remove the microorganisms that may be found on the surface of the dish. Sanitizing is possible by rinsing the dish in hot water at a temperature of 80°C for 1–2 minutes. Rinsing in warm water that contains chlorine (50–100 ppm) can replace the use of hot water. Immersing the rinsed dish for 15 seconds adequately sanitizes.
6. Dry the dish with a clean cloth or air-dry it. The cleaned and dried dish is then placed in a shelf or rack that has a cover. Dishes must be kept under cover until used. Remove dishes that are not in good condition and replace them with new ones.
7. The water used for washing must be changed frequently as needed. The used water in the first bowl is more frequently changed than that in the second bowl. Continued use of dirty water must not be encouraged. The water temperature in the third bowl must be kept high.

LAP Test	Practical Demonstration

Instructions: Given necessary templates, tools and materials you are required to perform the following tasks within 5min.

Task 1: Perform dish washing

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